

# MONITORING PROGRAM ANNUAL REPORT

## JANUARY - DECEMBER 2004

### ANCHORAGE WATER AND WASTEWATER UTILITY JOHN M. ASPLUND WATER POLLUTION CONTROL FACILITY AT POINT WORONZOF



Prepared for:



MUNICIPALITY OF ANCHORAGE  
Anchorage Water & Wastewater Utility  
Anchorage, Alaska

Prepared by:



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LABORATORIES  
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403 WEST 8TH AVE., ANCHORAGE, AK 99501  
(907) 276-6178

February 2005

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**NPDES Permit AK-002255-1**

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## **PREFACE**

This document is the Monitoring Program Annual Report required for submittal to the Environmental Protection Agency by NPDES Permit AK-002255-1 for discharge from the John M. Asplund Water Pollution Control Facility, operated by the Municipality of Anchorage at Point Woronzof. The NPDES permit incorporates provisions necessitated by a 301(h) waiver from the requirements of secondary treatment.

The elements of the monitoring program are:

- Influent, Effluent, and Sludge Monitoring
  - In-Plant Sampling
  - Toxic Pollutant and Pesticide Sampling
  - Pretreatment Monitoring
  - Whole Effluent Toxicity Monitoring
- Receiving Water Quality Monitoring
  - Plume Dispersion
  - Intertidal Zone Bacteria
- Sediment and Bioaccumulation Monitoring
  - Sediment Analyses
  - Bioaccumulation Analyses

During 2004, the program consisted of sampling the influent, effluent, and sludge twice for toxic pollutants and pesticides and one receiving water quality sampling. Bioaccumulation sampling was also performed during 2004. Bioaccumulation sampling had been scheduled for 2003 with the sediment analyses, but insufficient intertidal algae concentrations precluded the collection of samples in both 2003 and 2004. To fulfill the Permit objectives and requirements for a bioaccumulation program, it was proposed to EPA to perform a field bioaccumulation program utilizing a resident species from Upper Cook Inlet, the Pacific cod. This alternate study was approved by EPA and conducted in the fall of 2004. In addition, the Municipality of Anchorage conducted the required self-monitoring program for the influent, effluent, and sludge.

This annual report provides information concerning the monitoring program performed to meet the requirements as set forth in the NPDES permit that became effective on 2 August 2000. The report covers the period of 1 January through 31 December 2004.



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A3	Priority Pollutants, Dioxin, Pesticides, and Hydrocarbons Severn Trent Laboratories, Inc.
A4	Asbestos Solar Environmental Services, Inc. and EMSL Analytical, Inc.
A5	Enterococci Analytica Alaska, Inc.
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B2	Metals ToxScan, Inc.
B3	Priority Pollutants, Dioxin, Pesticides, and Hydrocarbons Severn Trent Laboratories, Inc.
B4	Asbestos Solar Environmental Services, Inc. and EMSL Analytical, Inc.
B5	Enterococci Analytica Alaska, Inc.
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- D2 Aromatic Hydrocarbons  
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Texas A&M GERG
- D4 Trace Metals  
Battelle
- D5 Intertidal Bacteria, Total Residual Chlorine, and Color  
Analytica Alaska, Inc.
- D6 Turbidity  
Soil Control Lab
- D7 Salinity  
Kinnetic Laboratories, Inc.
- D8 Hydrographic Data Profiles  
Kinnetic Laboratories, Inc.
- D9 Field Data Sheets  
Kinnetic Laboratories, Inc.

### **APPENDIX E**

#### **Bioaccumulation Monitoring**

- E1 Metals and Cyanide  
ToxScan, Inc. and Soil Control Lab
- E2 8270 Semi-volatiles, PAHs, EPA 8081A O-C Pesticides,  
and EPA 8082 PCB Aroclors  
Columbia Analytical Services, Inc.

## **SUMMARY**

### **PURPOSE**

This report is submitted in response to requirements of the U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC) as outlined in the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 that was signed on 30 June 2000 and became effective on 2 August 2000. This permit authorizes discharge of effluent from the John M. Asplund Water Pollution Control Facility (Asplund WPCF). Wastewater from the Municipality of Anchorage (MOA) is treated at this facility before discharge to the receiving waters of Knik Arm in Cook Inlet, Alaska. The NPDES permit incorporates the requirements necessitated by a 301(h) waiver from secondary treatment and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA, 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

### **HISTORY**

In September 1979, the MOA submitted to the EPA a 301(h) secondary treatment waiver application proposing an improved discharge which eliminated chlorination and required the addition of both a 610-meter (m) extension and a 305-m diffuser to the Asplund WPCF outfall. The outfall extension was intended to move the point of discharge beyond the influence of a gyre that was reported to exist off Point Woronzof on a flood tide which was presumed to carry effluent toward shore, causing bacterial contamination of the shoreline.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. The central issue was to evaluate outfall design alternatives and the chlorination/no chlorination option in relation to a system of eddies that occur on the flood tide. These studies were completed and presented as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985). This amended plan recommended the use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same water quality standards could be met by chlorinating and installing an improved diffuser at the end of the existing outfall, there was no need to extend the outfall.

Concurrent with the studies to amend the facilities plan, a revised 301(h) waiver application was submitted to the EPA. After extensive EPA review, public comment, and hearings, the Final Permit Decision was issued and the five-year NPDES permit became effective 16 October 1985 (EPA, 1985a). As required by this permit, a multi-port diffuser was installed in August 1987 prior to the second year of receiving water sampling. Fourteen years of monitoring were performed under the initial NPDES permit.

The MOA submitted an application to renew the 301(h) waiver from secondary treatment in 1990. A more recent application was submitted in 1998 with additional information provided to EPA in 1999. A draft NPDES permit that incorporated the 301(h) waiver was issued in 1999 for public comment. The renewed permit was signed by EPA on 30 June 2000 to become effective on 2 August 2000. This five-year permit specifies the required monitoring program and expires on 2 August 2005. The most recent application for an NPDES permit and 301(h) waiver was submitted this year on 31 January 2005.

## **RECEIVING WATER ENVIRONMENT**

The Asplund WPCF discharges into Knik Arm, a unique body of estuarine water with extremely high tidal fluctuations (up to 11.6 meters [m] with a mean range of 7.89 m at Anchorage; NOAA/NOS, 1995). These fluctuations produce extensive tidal flats, swift tidal currents of 4 - 5 knots, and intense mixing within the Inlet. The water is almost a slurry because of the naturally high suspended sediment concentrations of up to 2500 milligrams/liter (mg/L). This sediment originates from glacial melt waters discharging into Cook Inlet.

Large temperature extremes occur between summer and winter. In the winter, ice can reach thicknesses of 1 - 2 m and consists of broken pieces due to the large tides and currents. Other important factors are the large volume of saline water present in Cook Inlet and mixing by tidal turbulence which allows this volume to be effective in wastewater dilution and assimilation.

## **MONITORING OBJECTIVES**

The monitoring that was conducted during 2004 consisted of three main components: (1) in-plant monitoring of influent, effluent, and sludge, including whole effluent toxicity testing; (2) receiving water quality monitoring in the vicinity of the discharge and at a control site across Knik Arm; and (3) bioaccumulation monitoring in the vicinity of the discharge and at a control site across Knik Arm. Objectives of the 2004 program are summarized as follows:

### **2004 MONITORING OBJECTIVES**

#### **Influent, Effluent, and Sludge Monitoring**

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- help monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the CWA
- provide data for evaluation of permit re-issuance

#### **Water Quality**

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- aid in assessing the water quality at the discharge point
- determine compliance with the regulatory criteria of Section 301(h) for the CWA
- determine the level of bacterial contamination in nearshore waters
- provide data for evaluation of permit re-issuance

#### **Bioaccumulation Monitoring**

- determine compliance with the NPDES permit
- determine if pollutants from the discharge are accumulating in biological organisms
- provide data for evaluation of permit re-issuance

## **MONITORING RESULTS**

As part of its self-monitoring program, the Anchorage Water and Wastewater Utility (AWWU) conducted daily, weekly, and monthly sampling of influent, effluent, and sludge, depending on the parameter measured. In addition, monitoring for toxic pollutants and pesticides was conducted twice during 2004, once in June and once in August. Whole effluent toxicity testing was conducted quarterly, while water quality monitoring near the discharge was performed once in June. Bioaccumulation monitoring was performed in October. The following summarizes results from this year's monitoring based on the permit requirements:

### **2004 MONITORING RESULTS**

#### **Influent, Effluent, and Sludge**

- Met permit objectives and requirements and State of Alaska water quality standards (AWQS) with the exception of fecal coliform. Results from parameters of particular concern are summarized below.
- MOA's self-monitoring of total residual chlorine (TRC) showed that the daily maximum for TRC in the effluent was met for the entire year.
- The maximum geometric mean of 850 fecal coliform by most probable number technique per 100 milliliters (FC MPN/100 mL) was exceeded in August 2004 for fecal coliform, when a mean of 1,213 FC MPN/100 mL was reported. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in January, March, July, August, and September 2004. Exceedances resulted from the continuing adjustment of the Oxidation Reduction Potential chlorine feed control system in an effort to optimize chlorine use.
- Total aromatic hydrocarbon, total aqueous hydrocarbon, and total ammonia concentrations in the effluent were below their maximum allowable effluent concentrations (MAECs).
- Cyanide and metals concentrations in the effluent never exceeded their MAECs at any time during any of the 2004 sampling events.
- MOA's self-monitoring of pH, biochemical oxygen demand (BOD<sub>5</sub>), and total suspended solids (TSS) showed compliance with permit effluent limitations. TSS and BOD<sub>5</sub> were well within the daily, weekly, and monthly criteria for the entire reporting period. The annual percent removal rate for both TSS and BOD<sub>5</sub> were within required limits. Although not a permit requirement, BOD<sub>5</sub> removal in January was 29% which is below the 30% guideline.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were generally within the established range or lower than values from a national study of secondary treatment plants.

- Most toxic pollutant sludge concentrations were within the established range or lower than values from a national study of secondary treatment plants, with some metals falling outside typical concentrations but well below 95<sup>th</sup> percentile worst case values.
- Whole effluent toxicity testing conducted quarterly during 2004 met the permit limitations for chronic toxicity.

## **Water Quality**

- Little variation among stations was observed for most hydrographic parameters.
- To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, statistical comparisons were employed. Conventional parameters such as dissolved oxygen, salinity, and pH did show statistically significant differences between stations, but these were not ascribed to the outfall. Rather, these have historically been seen when comparing the Point Woronzof region to the slightly different water mass properties across Knik Arm at the control site. No significant differences were seen for temperature or turbidity.
- Fecal coliform concentrations in offshore receiving water samples were found to be very low everywhere. State-specified criteria of a median of 14 FC MPN/100 mL, a geometric mean of 20 FC MPN/100 mL, and of not more than 10 % of the samples exceeding 40 FC MPN/100 mL were met at all receiving water locations. All fecal coliform samples collected from intertidal areas also met water quality criteria.
- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that background levels of dissolved metals were all below the State site-specific water quality standards. Dissolved copper exceeded the site-specific standard at the diffuser, but since this was a within-ZID location is not considered a violation in Alaska Water Quality Standards. Significant differences between the outfall and control stations were seen for dissolved arsenic, cadmium, and nickel, which were elevated at the outfall. These increased concentrations as compared to controls may be attributed to the outfall, but these dissolved metals still met water quality standards. Total recoverable metals were elevated compared to the dissolved, as expected, and this was attributed to high suspended sediment loads. Only total recoverable cadmium and silver were significantly elevated at the outfall stations as compared to the control, also possibly due to increased suspended sediment levels.
- All cyanide concentrations in receiving waters were below detection limits of 1.0 microgram per liter (µg/L) compared to the receiving water quality limit of 1.0 µg/L.
- Supplemental receiving water samples also demonstrated that total aromatic hydrocarbons and total aqueous hydrocarbons met the State's water quality standard at all locations. While no statistically significant differences were detected between concentrations at the control and outfall stations for either total aromatic hydrocarbons or total aqueous hydrocarbons, slightly elevated levels were seen at the within-ZID boundary station that were attributed to the effluent discharge.

- Turbidity met the State water quality criteria at all stations. TRC exceeded the most restrictive AWQS at one station on the ZID boundary. Color was found to exceed State water quality criteria for six samples, five of which were within or on the ZID boundary and not considered a violation in AWQS. These exceedances in color however, could not be completely attributed to the outfall as the highest value was at a far removed location and may have been due to the naturally high suspended sediment in Knik Arm.

### **Bioaccumulation**

- Shallow subtidal/intertidal bioaccumulation analyses of Pacific cod showed no evidence of outfall impacts. Data from outfall and control sites were similar in terms of chemical concentrations, with most semi-volatile compounds and pesticides, found to be at or below detection limits. Arsenic, copper, mercury, selenium, and zinc were detected in the tissues at low concentrations, but no statistically significant differences were seen between the outfall and control locations. There was no evidence that pollutants attributable to the outfall are bioaccumulating in the resident biota in Knik Arm.

### **CONCLUSIONS**

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements with few exceptions and is showing no significant impacts to the marine environment.





## **1.0 INTRODUCTION**

### **1.1 REGULATORY/ENVIRONMENTAL BACKGROUND**

The monitoring program is designed to meet the requirements of the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 which authorizes discharge of municipal effluent into the Knik Arm of Cook Inlet receiving waters from the John M. Asplund Water Pollution Control Facility (Asplund WPCF), operated by the Municipality of Anchorage (MOA), Figure 1. The NPDES permit, which became effective on 2 August 2000, incorporates the requirements necessitated by a 301(h) secondary treatment waiver and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

#### **1.1.1 Regulatory Background**

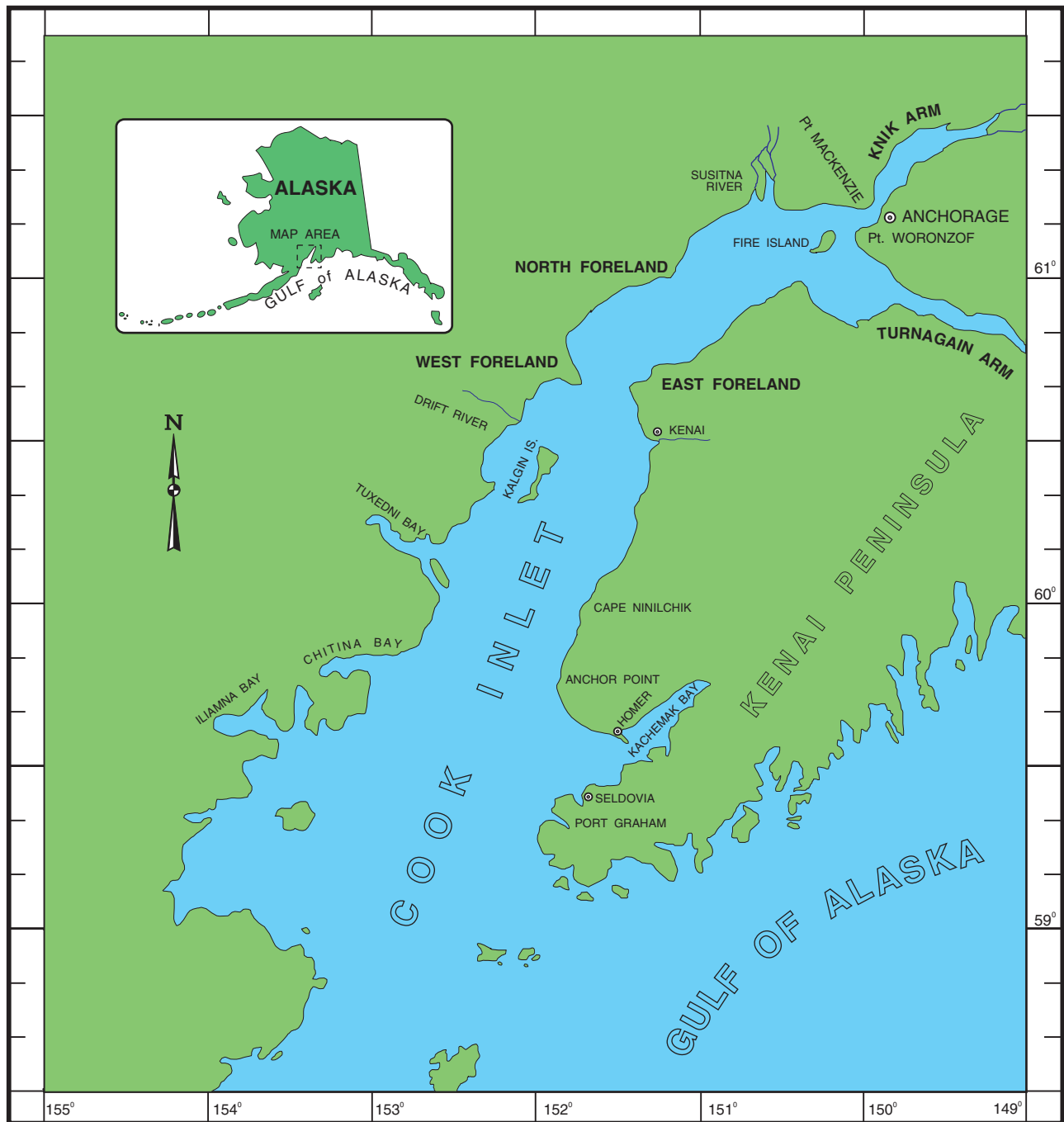
In 1972, while the Asplund WPCF and outfall were being built for the MOA, the Federal Water Pollution Control Act (FWPCA) was amended to establish two phases of effluent limitations applicable to all Publicly Owned Treatment Works (POTWs). Under 301(b), POTWs were required to achieve secondary treatment of effluent by 1 July 1977 and the "best practicable waste treatment technology" by July 1983.

Congress again amended the FWPCA in 1977. Section 301(h) was added, providing that the Administrator of the EPA, upon application from a POTW and with the concurrence of the State, might issue an NPDES permit waiving the requirements of Section 301(b). On 15 June 1979, EPA promulgated the regulations regarding the issuance of this waiver of secondary treatment to an applicant discharging into certain ocean and estuarine waters and demonstrating compliance with the 301(h) criteria.

In September 1979, the MOA forwarded to the EPA a 301(h) waiver application proposing an improved discharge which eliminated chlorination and required the addition of both an extension and diffuser to the Asplund WPCF outfall. Earlier studies had recommended the construction of a 610-m outfall extension and a 305-m diffuser. The proposed extension/diffuser reportedly could meet fecal coliform receiving water standards without chlorination and prevent shore contact of the wastewater plume.

As a parallel program, the MOA undertook preparation of a wastewater master plan for the Anchorage Bowl area. The resultant Wastewater Facilities Plan for Anchorage, Alaska (Ott Water Engineers, Inc. et al., 1982) and the Environmental Impact Statement, City of Anchorage, Alaska, Wastewater Facilities (EPA and Jones & Stokes, 1982) were accepted by the EPA and ADEC.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. Significant efforts were included in this study to improve the reconnaissance level data upon which the outfall length and diffuser design were to be based and to evaluate bacterial standards applicable to Knik Arm. The central issue was to evaluate outfall design alternatives and the chlorination or no-chlorination option in relation to the presence of a system of eddies that occur to the east of Point Woronzof on the flood tide and that might be capable of transporting the effluent shoreward.



**Figure 1. General Study Area.**

These latter studies were completed and presented as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985). This amended plan recommended use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same standards could be met by use of chlorination and the existing outfall, there was no need to extend the outfall. With continued chlorination, all water quality standards were predicted to be met by the amended plan.

Concurrent with the studies to amend the facilities plan, a revised application entitled Application for Modification of Secondary Treatment Requirements, Section 301(h), Clean Water Act was submitted to the EPA (CH2M Hill et al., 1984). The EPA Region 10 301(h) Review Team's Tentative Decision Document, entitled Analysis of the Section 301(h), Secondary Treatment Variance Application for the Asplund WPCF (EPA, 1985b), and a draft NPDES permit were made available for public comment on 17 January 1985. After comments and appropriate hearings, the Final Permit Decision (EPA, 1985a) was issued 13 September 1985, and the start date of the five-year NPDES Permit AK-002255-1 was listed as 16 October 1985. As required by this permit, a multi-port diffuser was installed at the Asplund WPCF outfall in the beginning of August 1987. This occurred prior to the 1987 summer water quality monitoring program. This original NPDES permit expired on 15 October 1990.

The MOA submitted a renewal application for the permit in April 1990 which addressed amendments made to the 301(h) provisions by the Water Quality Act. That renewal application was not acted upon and the facility continued to operate under an administrative extension of the 1985 permit until August 2000. In 1998 it was projected that the growth of Anchorage would result in the discharge limits contained in the 1985 permit being exceeded within a few years. Therefore, the MOA prepared and submitted another renewal application which replaced the 1990 application in October 1998 (CH2M Hill, 1998).

In tandem with the renewal application, the MOA conducted special studies and submitted a request for site-specific water quality criteria (SSWQC) to the ADEC for the Point Woronzof area of Cook Inlet in December 1998. This request for SSWQC was for turbidity and a suite of metals and was necessitated because the Alaska Water Quality Standards (AWQS) for marine waters could not be achieved for these waters as a result of the naturally high suspended sediment loads in Cook Inlet due to glacial inputs. The approach to the request was based on the EPA's Metals Policy that had been recently promulgated which recommends the use of only the dissolved fraction of metals as bioavailable and appropriate for the protection of aquatic life and associated beneficial uses of the water body. Following both agency and public review and comments, the SSWQC were incorporated into the AWQS as amended on 27 May 1999. The SSWQC for the Point Woronzof area included turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc.

Following the promulgation of these new AWQS, a tentative decision to grant the MOA its 301(h) variance was made by EPA on 4 November 1999. The tentative decision, draft NPDES permit, and fact sheet were then made available for public review and comments. The State of Alaska's Division of Government Coordination issued its Final Consistency Determination for the action in February 2000. The new NPDES permit for the Asplund WPCF was signed by EPA on 30 June 2000, went into effect 2 August 2000, and expires on 2 August 2005.

The NPDES permit specified the required monitoring program. The Monitoring Program Plan (Kinnetic Laboratories, Inc., 2000a), submitted to the EPA in October 2000, identified how the MOA plans to fulfill the requirements of this program. This report documents the progress and results of the monitoring program performed in 2004 under the current NPDES permit.

Since the issuance of the current Permit, with the exception of mercury and selenium, EPA has approved (EPA, 2004; letter to ADEC) ADEC's proposed use of dissolved metals for the State's marine water quality criteria. Except for cadmium where the dissolved standard changed from 9.3 to 8.8 µg/L, all other dissolved metals criteria are the same as those listed in the SSWQC.

### **1.1.2 Environmental Background**

The Asplund WPCF discharges to the receiving waters of Cook Inlet, Alaska. The discharge is located off Point Woronzof in Knik Arm of Upper Cook Inlet.

Cook Inlet is a major tidal estuary that is approximately 333 kilometers (km; 180 nautical miles) long and 93 - 148 km (50 - 80 nautical miles) wide at its lower end. Bathymetry indicates the Inlet is deep, generally 36.6 m (20 fathoms) north of the Forelands and about 164.6 m (90 fathoms) at the mouth. Numerous rivers, including the major Susitna River drainage, discharge into the Inlet. A detailed map of the Point Woronzof region indicates deep water (9.1 - 51.8 m) extending well past Anchorage up the Knik Arm (Figure 2).

Cook Inlet is a unique estuary, with perhaps the closest parallel being the Bay of Fundy between New Brunswick and Nova Scotia, Canada. The occurrence of tidal bores at the head, currents of 4 - 5 knots, suspended loads of up to 2500 mg/L, large temperature extremes, and moving pancake ice of up to one meter (m) thick make Cook Inlet unique. The high tidal ranges result from the geometry of the Inlet which has a natural resonance period close to the semi-diurnal tidal period. The resulting large tidal currents cause complete vertical mixing of the Inlet waters.

In addition to these features, two other factors are important to this study. They are the very large volume of saline water present in the Inlet and the degree of mixing achieved by the tidal turbulence which allow these volumes to be effective in wastewater dilution and assimilation.

The particle size distributions of the natural suspended sediments off Point Woronzof show that very large particles are suspended by the current-generated turbulence, with 50 percent (%) of the load being in the size range of 65 - 250 microns. The settling of large particles is seen in the Inlet at slack tide. Settling rate tests of the suspended material show that 93 % of the solids in the ambient water sample settle in twenty minutes.

Previous work has indicated that due to the extremely swift currents, no seabed accumulation of suspended sediments, either natural or from the discharge, occur in the vicinity of the outfall. In this location, the bottom is strictly coarse gravel and cobble because of these currents. However, areas of deposition do exist, such as to the east of Point Woronzof, where mudflats and beaches are found, and to the southwest of the Point. The area between Fire Island and the mainland is hard-packed sand with no deposition of silt or finer materials as a result of the high current energy. Silt sedimentation is a difficult problem at the Port of Anchorage where the Corps of Engineers conduct annual dredging operations. Of course, any suspended solids in these materials of effluent origin would be diluted by the much larger natural load in the receiving water (400 - 2,500 mg/L versus approximately 50 mg/L effluent).

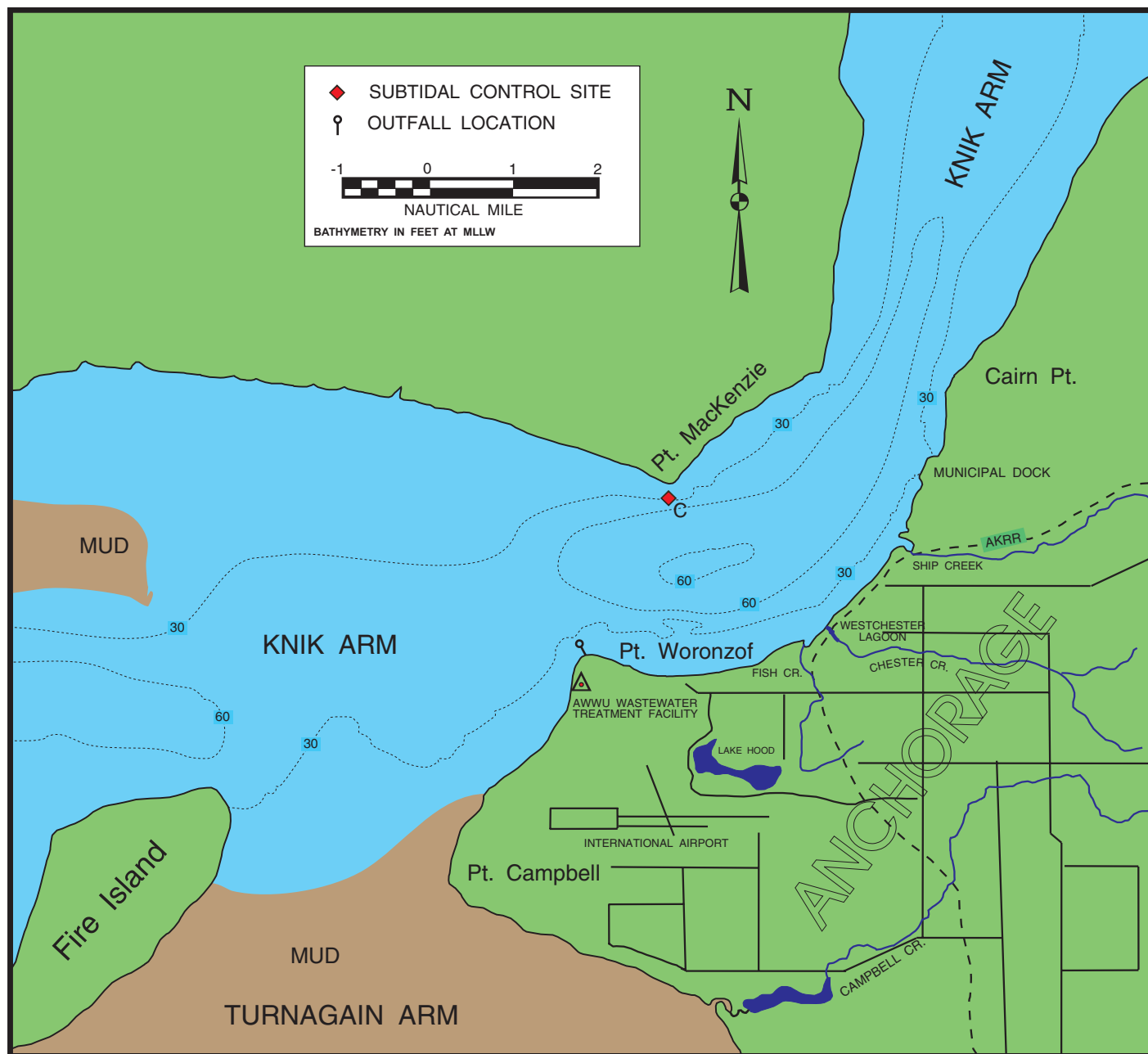


Figure 2. Asplund WPCF Outfall and Control Station Locations.

Studies have also shown that essentially no benthic biota are found on the scoured cobble/gravel bottom or on the rock beaches at Point Woronzof and the control area. Similar sampling of soft bottom beaches and tidal flats showed very sparse abundances and very low diversities. The harsh physical environment of silt, turbulence, currents, tides, and ice limit benthic and intertidal marine fauna populations.

Current trajectories in the immediate vicinity of the outfall are of concern because of flow separation zones on either side of Point Woronzof. Previous work has indicated that, on a flood tide, a clockwise system of eddies exist east of Point Woronzof. These eddies may result in the shoreward transport of wastes at certain stages of tide. A flow separation also exists to the west of Point Woronzof during ebb flow; however the effluent is not entrained shoreward in this area.

## **1.2 STUDY DESIGN**

### **1.2.1 Monitoring Objectives**

The monitoring program as described by NPDES Permit No. AK-002255-1 includes plant influent/effluent sampling; sewage sludge management procedures; water quality monitoring; biological and toxicological monitoring; and a toxics control program. The objectives of the overall monitoring program are to:

- determine compliance with the NPDES permit
- determine compliance with State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the Clean Water Act (CWA)
- determine the level of bacterial concentrations in nearshore waters
- monitor for changes in sediment quality (organic enrichment, alteration of grain size distribution, and pollutant contamination)
- determine if pollutants from the discharge are accumulating in exposed biological organisms
- provide data for evaluation of permit re-issuance

### **1.2.2 Program Description**

The elements of the monitoring program for the Asplund WPCF are:

- Influent, Effluent, and Sludge Monitoring, including
  - In-Plant Sampling
  - Toxic Pollutants and Pesticides (including Metals and Cyanide)
  - Pretreatment Monitoring
  - Whole Effluent Toxicity (WET) Testing
- Receiving Water Quality Monitoring, including
  - Plume Dispersion
  - Intertidal Bacteria

- Biological and Sediment Monitoring, including
  - Sediment Quality
  - Bioaccumulation

Table 1 provides an overview of the monitoring requirements as described by the permit. Detailed information regarding each program component is provided in Section 2.0, Methods.

### 1.2.3 Hypotheses

The null (no effect) hypotheses tested for this year of monitoring as follows:

*H<sub>o1</sub>: Applicable State and Federal effluent and receiving water standards were met by the Asplund WPCF discharge.*

*H<sub>o2</sub>: Water quality at the boundary of the ZID was not significantly changed with respect to nearfield or control stations.*

## 1.3 CONTRACTOR

The MOA's designated contractor for the 2004 Asplund WPCF Monitoring Program was Kinnetic Laboratories, Inc. (KLI) of Anchorage, Alaska.

For influent, effluent, and sludge monitoring, aromatic hydrocarbon, pesticide, and volatile and semi-volatile priority pollutant analyses (gas chromatography/mass spectrometry scans) were performed by Severn Trent Laboratories, Inc. of Sacramento, California. Trace metals (total and dissolved antimony, selenium, and thallium) and WET testing were performed by ToxScan, Inc. in Watsonville, California. Asbestos analyses were performed by Solar Environmental Services, Inc. of Anchorage, Alaska, and EMSL Analytical of Westmont, New Jersey.

In addition, the Municipality's Asplund WPCF Laboratory performed monthly in-plant analyses as part of its self-monitoring program and conducted trace metals and cyanide analyses for the toxic pollutant and pesticide, pretreatment, and Part 503 sludge monitoring.

Analytica Alaska Inc. of Anchorage, under subcontract to KLI, provided analytical and field support for the receiving water sampling for bacteriology, color, and total residual chlorine (TRC). Analytical support for the receiving water sampling included: Battelle for trace metals (Sequim, Washington), Soil Control Lab (Watsonville, California) for total suspended solids (TSS), turbidity, and cyanide, Severn Trent Laboratories, Inc. in California for aromatic hydrocarbons, Texas A&M University's Geochemical and Environmental Research Group (GERG) in Texas for polycyclic aromatic hydrocarbons (PAHs) analyses. Bioaccumulation monitoring analyses for PAHs, PCBs, pesticides, and semi-volatiles were performed by Columbia Analytical Services, Inc. of Kelso, Washington while metals and cyanide analyses were performed by ToxScan, Inc. and Soil Control Lab.

## 1.4 PERIOD OF REPORT

This report documents the progress and results of the monitoring program from 1 January through 31 December 2004 under the current NPDES permit.

**Table 1. Overall Monitoring Requirements.**

Parameter	Frequency	Sample Type	Remarks
In-Plant Sampling	See Table 2	See Table 2	See Table 2 - includes flow, TRC, DO, BOD <sub>5</sub> , TSS, temperature, pH, fecal coliform, total ammonia as nitrogen, enterococci bacteria, and oil and grease
Toxic Pollutants and Pesticides (including Metals and Cyanide)	2/year <sup>a</sup>	influent, 24-hr composite effluent, 24-hr composite sludge, 24-hr composite	See Table 2
Pretreatment Program	2/year <sup>a,b</sup>	influent, three 24-hr composite effluent, three 24-hr composite sludge, 24-hr composite (8 grabs/day)	Includes metals and cyanide plus percent solids for sludge
Whole Effluent Toxicity (WET) Testing	4/year <sup>c</sup>	effluent, 24-hr composite	See Table 2
Receiving Water Quality	1/year <sup>d</sup>	receiving water	See Table 5
Intertidal Bacteria	1/year <sup>e</sup>	intertidal receiving water	Fecal coliform sampling at 8 intertidal stations
Sediment	Once during the fourth year of the permit <sup>e</sup>	grab samples of surficial (0-2 cm) sediment collected at intertidal and subtidal stations <sup>f</sup>	Includes total volatile solids (TVS), toxic pollutants and pesticides (including metals and cyanide), and sediment grain size distribution
Bioaccumulation	Once during the fourth year of the permit <sup>g</sup>	grab samples of intertidal macroalgae ( <i>Vaucheria</i> spp.)  Note: Macroalgae was not available during 2003 or 2004. Therefore, in consultation with EPA and AWWU Pacific cod ( <i>Gadus macrocephalus</i> ) were collected and analyzed for this permit component. <sup>h</sup>	Includes toxic pollutants and pesticides (including metals and cyanide)

<sup>a</sup> Sampling will be conducted twice per year: once in summer dry conditions and once in summer wet conditions.

<sup>b</sup> The first day of three consecutive days of sampling will be part of the Toxic Pollutant and Pesticides (metals and cyanide) sampling performed twice each year.

<sup>c</sup> WET testing will be performed on a quarterly basis.

<sup>d</sup> Sampling will be conducted once per year in summer dry conditions.

<sup>e</sup> Sampling will be conducted in conjunction with the receiving water sampling.

<sup>f</sup> Sampling will be performed at Intertidal Stations 1, 2, and Control (IT-1, IT-2, and IT-C); a subtidal station located at the ZID boundary, and a subtidal control station near Point MacKenzie (in a similar water depth as the ZID boundary).

<sup>g</sup> Sampling was to be performed in conjunction with the sediment analyses however algae was not available in sufficient quantities for sampling in 2003 or 2004. Pacific cod were collected and analyzed for this permit component.

<sup>h</sup> Four replicates of pacific cod were collected near Point Woronzof and three replicates were collected near the control station.



## 2.0 METHODS

### 2.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING

Influent, effluent, and sludge monitoring is outlined in Table 2. Routine daily, weekly, and monthly sampling of conventional pollutant parameters and flow rate were performed by AWWU. The less-frequently monitored parameters of enterococci bacteria, oil and grease, toxic pollutants and pesticides (including metals and cyanide), and Whole Effluent Toxicity (WET) testing were handled by AWWU and KLI.

- ✓ determine compliance with the NPDES permit and State of Alaska water quality criteria
- ✓ determine effectiveness of the industrial pretreatment program
- ✓ aid in assessing the water quality at the discharge point
- ✓ characterize toxic substances
- ✓ help monitor plant performance
- ✓ determine compliance with the regulatory criteria of Section 301(h) of the CWA
- ✓ provide data for evaluating re-issuance of this permit

#### 2.1.1 In-Plant Monitoring

In-plant influent, effluent, and sludge sampling was performed by AWWU personnel as described in Table 2 and in a separate study plan provided by AWWU (AWWU, 2000). Samples were obtained following the schedule of frequency required by the permit. Influent was sampled at a representative location in the influent headworks, upstream from the recycle streams. Effluent was sampled at a well-mixed point downstream from the chlorination input (the final effluent line). Composite sludge samples were obtained from the belt filter press. Grab samples were obtained for total residual chlorine (TRC), dissolved oxygen (DO), temperature, pH, and fecal coliform. Composite samples were obtained for analysis of biochemical oxygen demand (BOD<sub>5</sub>), total suspended solids (TSS), and total ammonia as nitrogen.

#### 2.1.2 Toxic Pollutant and Pesticide Monitoring

As outlined in the permit, toxic pollutant and pesticide sampling was conducted twice this year, once during June 2004 (summer dry) and once during August 2004 (summer wet). Samples were collected as required by the permit and either analyzed by AWWU personnel or provided to KLI for shipment to the appropriate analytical laboratory. Plant influent was sampled as discrete grabs or by flow-proportional composite samplers (depending on the analysis method) at a representative location in the influent headworks upstream from the recycle streams. Effluent was sampled as discrete grabs or flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Influent and effluent samples were chilled as required during composite sampling. Composite sludge samples were obtained from the belt filter press.

Samples were composited for the analysis of pesticides, semi-volatile organics, metals, asbestos, and cyanide. Samples consisted of composites of flow-proportioned samples collected over a 24-hour (hr) period using two ISCO Model 3700 Refrigerated Autosamplers. Grab samples for volatile organics analysis were collected every three hours during the 24-hr sampling period and designated for compositing during analysis at the laboratory. Grab samples were collected for

**Table 2. Influent, Effluent, and Sludge Monitoring Requirements.**

Parameter	Sample Point <sup>a</sup>	Sample Frequency	Sample Type
Flow <sup>b</sup>	effluent	continuous	continuous
Total Residual Chlorine (TRC) <sup>b</sup>	effluent	continuous <u>or</u> every 2-4 hrs	grab
Dissolved Oxygen (DO) <sup>b</sup>	effluent	4/week	grab
Biochemical Oxygen Demand (BOD <sub>5</sub> ) <sup>b</sup>	influent and effluent	4/week	24-hr composite
Total Suspended Solids (TSS) <sup>b</sup>	influent and effluent	4/week	24-hr composite
Temperature <sup>b</sup>	influent and effluent	4/week	grab
pH <sup>b</sup>	influent and effluent	4/week	grab
Fecal Coliform Bacteria <sup>b</sup>	effluent	3/week	grab
Total Ammonia as N <sup>b</sup>	effluent	1/month	24-hr composite
Enterococci Bacteria <sup>c</sup>	effluent	2/year <sup>d</sup>	grab
Oil and Grease <sup>b</sup>	effluent	2/year <sup>d</sup>	grab
Toxic Pollutants and Pesticides (including Metals and Cyanide) <sup>e</sup>	influent, effluent, and sludge	2/year <sup>d</sup>	24-hr composite
WET <sup>f</sup>	effluent	4/year <sup>f</sup>	24-hr composite

<sup>a</sup> When both influent and effluent samples are required, samples will be collected during the same 24-hr period.

<sup>b</sup> AWWU will perform this monitoring component.

<sup>c</sup> KLI will perform this monitoring component.

<sup>d</sup> Twice per year sampling: once during summer in dry conditions and once in wet conditions.

<sup>e</sup> As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc in influent, effluent, and sludge will be sampled, along with percent solids (in sludge only). These metals will be analyzed and reported by AWWU as total recoverable metals and dissolved metals for influent and effluent and as total metals in mg/kg dry weight for sludge. Sampling will be as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Mon - Fri), the first day of which coincides with the twice yearly sampling (summer-dry and wet conditions); sludge as one composite of eight grabs/day when influent and effluent samples are being taken. In addition, the other four metals from the toxic pollutant list will be analyzed in the summer wet/summer dry samples: beryllium (by AWWU) and antimony, thallium, and selenium (by KLI).

<sup>f</sup> WET requirements are summarized in the text (Section 2.1.4). Initial testing will be a screening period performed during three quarters, during which three species will be tested to determine the most sensitive species. Re-screening will be performed each year during one quarter (different than the previous year) to determine the species to use for continued testing. Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units, TUC=100/NOEC).

analysis of total hydrocarbons as oil and grease and purgeable aromatic compounds. Sludge samples were collected from the conveyor belt every three hours over a 24-hr period and the eight samples composited.

At time of collection, all samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.5. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

Toxic pollutants as defined by the permit are those substances listed in 40 Code of Federal Regulations (CFR) 401.15 (Table 3). This list involves 65 categories of pollutants, including asbestos, aromatic hydrocarbons, pesticides, metals, and polychlorinated biphenyls (PCBs). Pesticides as defined in the permit are demeton, guthion, malathion, mirex, methoxychlor, and parathion as listed in 40 CFR 125.58. Other pesticides which were tested are included on the toxic pollutants list (40 CFR 401.15). The methods that were used to analyze these constituents for this program and for which KLI will be responsible, as well as those performed by AWWU, are also provided in Table 3. Preservation and maximum holding time information for each of these methods is provided in Table 4. All samples were collected in the appropriate precleaned sample containers and preserved, if necessary, as described by the EPA method. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

### **2.1.3 Pretreatment Monitoring**

The pretreatment program as outlined in Table 1 and Table 2 was performed by the AWWU. This monitoring was performed twice in 2004 in conjunction with the summer dry and wet sampling. As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc in influent, effluent, and sludge were sampled, along with percent solids (in sludge only). These metals were analyzed and reported by AWWU as total recoverable metals and dissolved metals for influent and effluent and as total recoverable metals in dry weight for sludge. Sampling was conducted as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Monday - Friday), the first or second day of which coincided with the twice-yearly sampling (dry wet and summer dry, respectively); sludge as one composite of eight grabs/day when influent and effluent samples were being taken. A detailed study plan describing this monitoring was provided previously (AWWU, 2000).

### **2.1.4 Whole Effluent Toxicity Testing**

As outlined in the permit, the WET testing must be performed on a quarterly basis on 24-hr composite effluent samples. Effluent was sampled by discrete flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Effluent samples were collected in the appropriate precleaned sample containers as described by the method, chilled, and shipped immediately to the toxicity laboratory for testing. Samples were appropriately labeled at the time of collection using pre-prepared, project-specific sample labels as described in Section 2.5. Sample collection and shipment were documented using project-specific chain of custody forms as described in Section 2.5. Sample containers were immediately placed on gel ice after sampling and remained chilled during shipment to the analytical laboratory.

**Table 3. Methods<sup>a</sup> for the Analysis of Toxic Pollutants and Pesticides for Influent, Effluent, and Sludge Monitoring.**

Volatile Organic Compounds	Semi-Volatile Organic Compounds	Pesticides and PCBs	Inorganic Compounds
<b>EPA 624 (Inf/Eff)</b> <b>SW 8260B (Sludge)</b> Benzene Chlorinated benzenes Dichlorobenzenes Ethylbenzene Toluene Xylenes <sup>b</sup>	<b>EPA 625 (Inf/Eff)</b> <b>SW 8270C (Sludge)</b> Acenaphthene Benzidine <sup>c</sup> Chloralkyl ethers Chlorinated ethanes Chlorinated naphthalenes Chlorinated phenols 2-chlorophenol DDT & metabolites Dichlorobenzenes Dichlorobenzidine 2,4-dichlorophenol 2,4-dimethylphenol Dinitrotoluene Diphenylhydrazine Fluoranthene Haloethers Heptachlor & metabolites Hexachlorobutadiene Hexachlorocyclopentadiene <sup>c</sup> Hexachloroethane Isophorone Naphthalene Nitrobenzene Nitrophenols Nitrosamines Polycyclic aromatic hydrocarbons (PAHs) Pentachlorophenol Phenol Phthalate esters	<b>EPA 614 (Inf/Eff)</b> <b>SW 8141A (Sludge)</b> Demeton Malathion Parathion Guthion <sup>b</sup>	<b>EPA 100.1/EPA 100.2 (Inf/Eff)</b> <b>Polarized Light Microscopy (PLM; Sludge)</b> Asbestos
<b>EPA 624 (Inf/Eff)</b> <b>SW 8260B (Sludge)</b> Acrolein <sup>b</sup> Acrylonitrile <sup>b</sup> Benzene Carbon tetrachloride Chloralkyl ethers Chloroform Chlorinated benzenes Chlorinated ethanes 1,2-dichloroethane Dichloroethylenes Dichloropropane Dichloropropene 1,1,1-trichloroethane Ethylbenzene Halomethanes Methylene chloride Bromoform Dichlorobromomethane Toluene Tetrachloroethylene Trichloroethylene Vinyl chloride	<b>EPA 608 (Inf/Eff)</b> <b>SW 8081A Pesticides and SW 8082 PCBs (Sludge)</b> Aldrin/Dieldrin Chlordane (technical mixture & metabolites) DDT & metabolites Endosulfan & metabolites Endrin & metabolites Heptachlor metabolites Hexachlorocyclohexane Polychlorinated biphenyls (PCBs) Toxaphene Mirex <sup>b</sup> Methoxychlor <sup>b</sup>	<b>EPA 200.8 (Inf/Eff)</b> <b>SW 6020/SW 3050B (Sludge)</b> Antimony Thallium  <b>EPA 270.3 (Inf/Eff)</b> <b>SW 7741A/SW 3050B (Sludge)</b> Selenium  Note: other inorganic compounds will be analyzed by AWWU (Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Zinc, and Cyanide)	
	<b>SW 8280A (Inf/Eff/Sludge)</b> 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)		

Inf Influent

Eff Effluent

<sup>a</sup> "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

<sup>b</sup> Included with expanded method analyte list.

<sup>c</sup> Not the preferred method for this analyte.

**Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.**

<b>Parameter</b>	<b>Sample Type</b>	<b>Preservation</b>	<b>Maximum Holding Time</b>	<b>Method<sup>a</sup></b>
Temperature	Inf/Eff	None required	Analyze immediately	SM 2550B
pH	Inf/Eff	None required	Analyze immediately	SM 4500-H <sup>+</sup> B
BOD <sub>5</sub>	Inf/Eff	Cool, 4°C	48 hours	SM 5210B
Total Residual Chlorine	Eff	Fill completely	Analyze immediately	Hach 8167
DO Electrode	Eff	None required	Analyze immediately	SM 4500-O G
Suspended Solids	Inf/Eff	Cool, 4°C	7 days	SM 2540D
Total Solids	Sludge	Cool, 4°C	7 days	SM 2540G
Enterococci	Inf/Eff	Cool, 4°C, Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in effluent	24 hours	SM 9230B
Asbestos	Inf/Eff	Cool, 4°C, dark	Filter within 48 hours of receipt at lab	EPA 100.1/100.2
	Sludge	Cool, 4°C	28 days	Polarized Light Microscopy (PLM)
Fecal Coliform Bacteria	Eff	Cool, 4°C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	6 hours	EPA 600/8-78-017
Total Ammonia as N Eff		Cool, 4°C, H <sub>2</sub> SO <sub>4</sub> to pH <2	28 days	Hach 8038
Total Hydrocarbons as Oil and Grease	Inf/Eff	Cool, 4°C, dark HCl to pH<2	28 days	EPA 1664 HEM <sup>b</sup>
Volatile Organics	Inf/Eff	Cool, 4°C, dark, HCL to pH<2 L- Ascorbic Acid in effluent	14 days	EPA 624
	Sludge	Cool, 4°C	14 days	SW 8260B
Dioxins	Inf/Eff	Cool, 4°C	30 days until extraction/45 days after extraction	SW 8280A
	Sludge	Cool, 4°C	30 days until extraction/45 days after extraction	SW 8280A
Semi-Volatile Organics	Inf/Eff	Cool, 4°C, dark L- Ascorbic Acid in effluent	7 days until extraction/40 days after extraction	EPA 625
	Sludge	Cool, 4°C	14 days until extraction/40 days after extraction	SW 8270C
Pesticides & PCBs	Inf/Eff	Cool, 4°C, L- Ascorbic Acid in effluent	7 days until extraction/ 40 days after extraction	EPA 614 and EPA 608
	Sludge	Cool, 4°C	14 days until extraction/40 days after extraction	SW 8141A/8081A SW 8082

**Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.**  
(continued)

Parameter	Sample Type	Preservation	Maximum Holding Time	Method <sup>a</sup>
Cyanide (total)	Inf/Eff	Cool, 4°C, NaOH to pH>12, 0.6 g L- Ascorbic acid (in effluent)	14 days	SM 4500 CN C,E
	Sludge	Cool, 4°C	14 days	SM 4500 CN C,E
Arsenic	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 206.2
	Sludge	Cool, 4°C	6 months	SW 7060/3050A
Beryllium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 210.2
	Sludge	Cool, 4°C	6 months	SW 7091/3050A
Cadmium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 213.2
	Sludge	Cool, 4°C	6 months	SW 7130/3050A
Chromium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 218.2
	Sludge	Cool, 4°C	6 months	SW 7191/3050A
Copper	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	SM 3111B
	Sludge	Cool, 4°C	6 months	SW 7210/3050A
Lead	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 239.2
	Sludge	Cool, 4°C	6 months	SW 7421/3050A
Mercury	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	28 days	EPA 245.1
	Sludge	Cool, 4°C	28 days	SW 7470
Nickel	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 249.2
	Sludge	Cool, 4°C	6 months	SW 7521/3050A
Selenium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 270.3
	Sludge	Cool, 4°C	6 months	SW 7741A/3050B
Silver	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 272.2
	Sludge	Cool, 4°C	6 months	SW 7761/3050A
Zinc	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	SM 3111B
	Sludge	Cool, 4°C	6 months	SW 7950/3050A
Antimony	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 6020/3050B
Thallium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH <2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	SW 6020/3050B (digestion)

<sup>a</sup> Unless otherwise noted, "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 20th ed., 1998. "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

<sup>b</sup> EPA, 1999a. Document No. EPA-821-R-98-002.

Inf Influent  
Eff Effluent

Initial WET testing was performed as a screening period over the course of three quarters during each of which three toxicity tests were performed, each with one vertebrate and two invertebrate species. These screening tests were performed during the third and fourth quarters of 2000 and the first quarter of 2001. Screening included the vertebrate *Atherinops affinis* (topsmelt) for survival and growth; an invertebrate bivalve species (either *Mytilus* spp. [mussel; survival and growth] or *Crassostrea gigas* [oyster; larval development]; and an invertebrate echinoderm species fertilization test (*Strongylocentrotus purpuratus* [purple urchin] or *Dendraster excentricus* [sand dollar]). Once the screening period was completed, the single most sensitive species (bivalve) was used for subsequent toxicity testing until re-screening was completed. As required by the permit, re-screening must be performed each year during one quarter (different than the previous year) to determine the most sensitive species to use for continued testing. Re-screening was performed in the second quarter of 2002, with bivalve testing performed during the other three quarters. In 2003, re-screening was performed during the third quarter, and bivalve testing was performed during the remainder of the year. Re-screening was performed in the fourth quarter of 2004, with bivalve testing performed during the quarterly periods.

Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units,  $TUC = 100 / \text{No Observed Effect Concentration [NOEC]}$ ). Accelerated testing will include the implementation of the initial investigation Toxicity Reduction Evaluation (TRE) workplan along with at least one additional toxicity test. If the investigation indicates the source of toxicity (e.g., a plant upset), and no toxicity greater than 143 TUC is observed in this test, the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed, then accelerated testing will continue with six more tests performed on a biweekly basis over a 12-week period. Testing will commence within two weeks of receipt of the sample results of the exceedance. If no toxicity greater than 143 TUC is observed in these tests, then the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed in any of the six tests, then a TRE will be initiated within 15 days of receipt of the sample results of the exceedance. A Toxicity Identification Evaluation (TIE) may also be initiated as part of the overall TRE process, and if this is initiated during the accelerated testing period, the accelerated testing schedule may be terminated or used as necessary in performing the TIE.

Toxicity testing was performed as described in Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms (EPA, 1988) and the 'West Coast Marine Methods Manual', First Edition (EPA, 1995) as required by the permit. The presence of chronic toxicity was estimated as described by these references. Quality assurance for the toxicity testing included the testing of a series of five dilutions and a control, including the concentration of the effluent at the edge of the ZID (0.70 %) as well as two dilutions above and two dilutions below 0.70 %. Reference toxicants were tested concurrently with the effluent testing, using the same procedures. If the effluent tests did not meet all the acceptability criteria as specified in the referenced methods, then the effluent was re-sampled and re-tested as soon as possible. Control and dilution water was natural or synthetic seawater as called for by the referenced methods. If the dilution water was different from the culture water, a second control using culture water will be run. Dilution water met test acceptability criteria.

As part of the WET testing, an initial investigation TRE plan was prepared and submitted to EPA under separate cover (Kinnetic Laboratories, Inc., 2000b). This plan describes the events that will occur should chronic toxicity be detected. As required by the permit and the manual Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants (EPA, 1999b), a preliminary TRE will be initiated within 15 days of the receipt of sample results of the

permit exceedance. A more detailed TRE workplan will subsequently be developed to more fully investigate and identify the cause of the toxicity, identify and provide a schedule of the actions that AWWU will use to mitigate the impact of the discharge, and to prevent the recurrence of the toxicity. As noted above, the TIE may be initiated as part of the overall TRE process during the accelerated testing schedule.

### 2.1.5 Part 503 Sludge Monitoring

Operations at the Asplund WPCF include a sludge incinerator that is subject to regulation under 40 CFR Part 503—Standards for the Use or Disposal of Sewage Sludge (Part 503). The current permit requires sludge monitoring twice per year, once during the dry conditions in summer and once during wet conditions as noted above. There are no Part 503 monitoring requirements included in the reissued permit because EPA Region 10's current policy is to remove these requirements from NPDES permits with the intention of writing "sludge only" permits in the future. However, the Part 503 regulations are "self-implementing" in that the facility is required to meet the monitoring requirements in the regulation whether they are specifically included in a permit or not. Therefore, monitoring at the Asplund WPCF includes Part 503 monitoring of sludge. Monitoring frequencies required by 40 CFR Part 503 for incineration are once per 60 days for arsenic, cadmium, chromium, lead, and nickel. Frequency required for mercury is at least once per year. Frequency for beryllium is not specified. AWWU has chosen to also test mercury and beryllium once per 60 days, more frequently than required, so as to be consistent with the testing frequency for the other metals. Allowable limits are site-specific and were calculated per Part 503 regulation in the *Air Operating Permit Application* submitted by AWWU to ADEC in December 1997 (CH2M Hill, 1997). While methods for this monitoring component have been described elsewhere (AWWU, 2000) and results of the monitoring have been provided under separate reporting requirements to EPA, the data are also included in this report.

## 2.2 RECEIVING WATER QUALITY MONITORING

### 2.2.1 Water Quality Sampling

As called for by the permit, water quality must be monitored annually during the summer in dry weather conditions (Table 1). Sampling was performed at non-fixed stations made during consecutive ebb and flood tides at the outfall station and a single flood tide at the control station. Station locations were determined by following the track of drogues released above the diffuser at the outfall station and at the control station located north across Knik Arm from Point Woronzof, directly off Point MacKenzie in a similar water depth as the outfall. Three drogue tracks on each tide were performed at each location. Four stations were sampled on each drogue track:

- |  |
|--|
| <ul style="list-style-type: none"><li>✓ determine compliance with the NPDES permit and State of Alaska water quality criteria</li><li>✓ aid in assessing the water quality at the discharge point</li><li>✓ determine compliance with the regulatory criteria of Section 301(h) for the CWA</li><li>✓ determine the level of bacterial contamination in nearshore waters</li><li>✓ provide data for evaluation of permit re-issuance</li></ul> |
|--|

- above the diffuser
- as close to the ZID boundary as practicable
- at least one station in the channel of Knik Arm
- in the shallow subtidal area before the drogue grounds.



As noted in the permit, the ZID is defined as the water column above the area delineated by the sector of a circle with the center located over the outfall, 30 meters (m) shoreward of the diffuser, 650 m in radius, and with a 220° angle (Figure 3).

The plume location was followed by using a holey-sock drogue (Figure 4). The drogue consisted of a six-foot cylindrical nylon tube ballasted at the bottom with a two-pound weight and attached at the top with a bridle to a spherical float. This float attached to the tracking spar via a connecting line. These cylindrical or spherical designs that enclose a parcel of water have been found to more accurately follow the ambient current patterns than other drogue designs such as the window shade design (Sombardier and Niiler, 1994).

Sampling was performed by positioning the vessel over the diffuser (or control station) for the first sampling station of the drogue track. The drogue was released at approximately the same time and followed until navigation information indicated that the ZID has been reached, at approximately 650 m from the outfall, at which time the ZID boundary station was sampled. The third and fourth stations along each drogue track were sampled as the drogue traveled through the channel in Knik Arm and as it slowed in shallow water prior to grounding. Navigation was accomplished using a differential global positioning system (DGPS). If DGPS coordinates were unavailable, a standard GPS receiver was used to obtain navigational information. Range and bearing to fixed landmarks on shore using the vessel's radar may also have been recorded to aid in station positioning.

Samples were collected for the parameters outlined in Table 5. The surface waters of all stations were sampled for fecal coliform, color, and TRC. Surface samples were collected by grabbing directly into the appropriate sample bottles at sample depth (15 - 30 centimeters [cm]). Turbidity samples were collected at all stations from surface (0.5 m), mid-, and bottom depths using Niskin<sup>®</sup> bottles. Mid- and bottom depths were determined at each station using the survey vessel's fathometer. Samples were collected as simultaneously as possible at all three target depths. Hydrographic profiles of temperature, salinity, and pH were collected at all stations using a Seabird SEACAT<sup>®</sup> CTD (conductivity, temperature, and depth) sensor. This instrument was also equipped with a DO sensor to allow DO profiles to be recorded. Samples for the analysis of total and dissolved metals, TSS, hydrocarbons (PAH), and total volatile aromatic hydrocarbons (TAH) were collected from surface waters at the first three stations (diffuser, ZID boundary, and channel) along the first flood drogue track at both the outfall and control stations. These samples were collected directly into the appropriate sample containers. A single replicate sample for each parameter or a single profile was collected at each station except for quality control samples, which are described in Section 4.2.

Samples were analyzed following the methods provided in Table 6. Samples were appropriately labeled at time of collection using pre-prepared, project-specific sample labels as described in Section 2.5 and prepared for shipment to the laboratory. Preservation and maximum holding time information for each of these methods is also provided in Table 6. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

## **2.2.2 Intertidal Bacterial Sampling**

As part of the water quality monitoring effort, intertidal sampling for fecal coliform bacteria was also performed at eight intertidal stations provided in Table 7 and depicted in Figure 3. Two

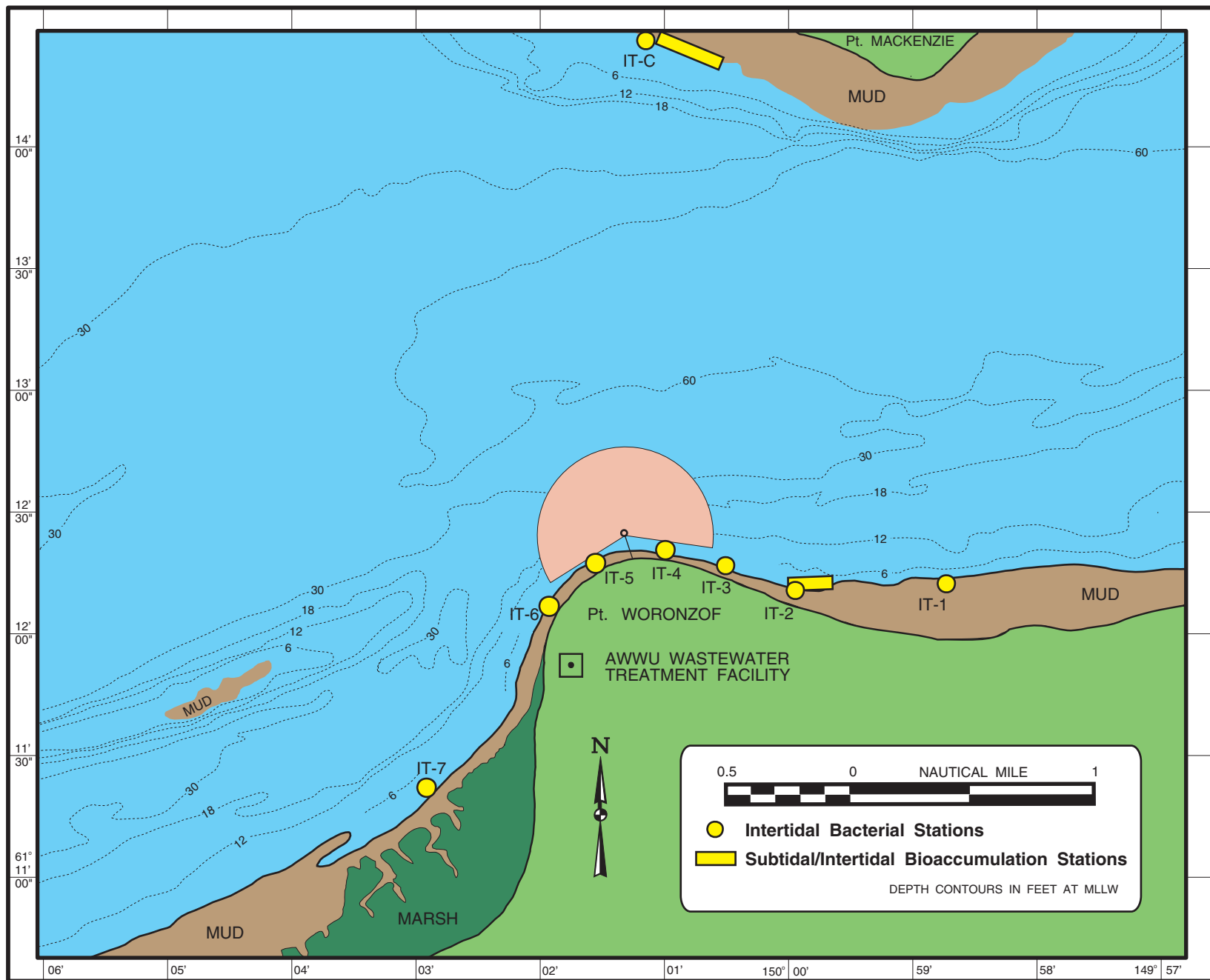
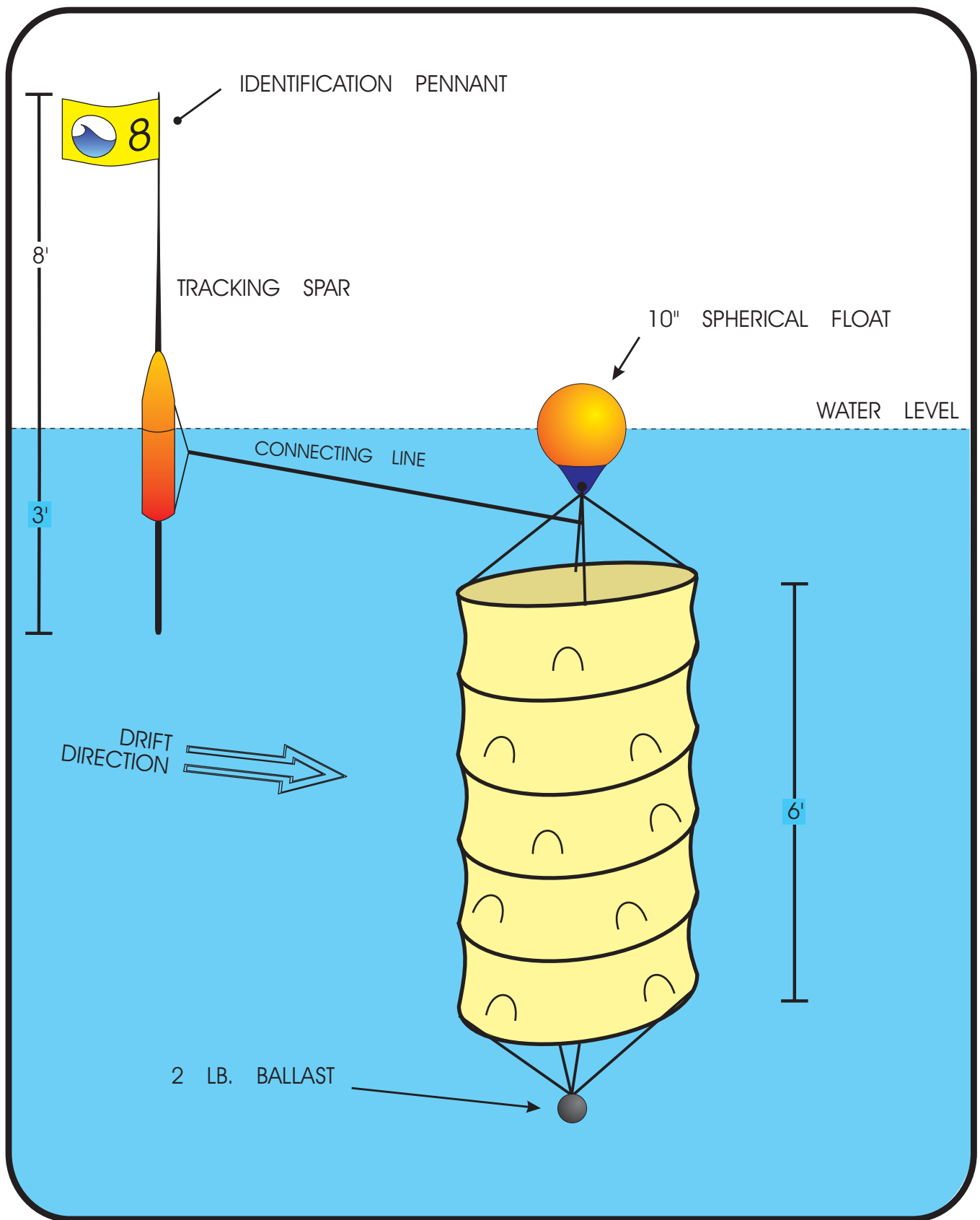


Figure 3. Asplund WPCF Outfall, ZID, and Locations of Bacterial and Bioaccumulation Beach Seine Sampling.



**Figure 4. Holey-Sock Drogue, Flotation, and Marker Buoy.**

**Table 5. Receiving Water Quality Monitoring Requirements.**

Parameter	Sampling Depth		
	Surface (above 0.5 m)	Surface, Mid-, and Bottom	Profile (1- to 3-m intervals)
Fecal Coliform	all stations <sup>a</sup> , within the 15-30 cm layer		
Color	all stations		
Total Residual Chlorine (TRC)			
Field Observations: presence or absence of floating solids, visible foam (other than trace), oil wastes, and/or sheen	all stations where surface samples are collected		
Total Aqueous Hydrocarbons (TAqH)	first three stations along the first flood drogue track at both the outfall and control locations		
Total Aromatic Hydrocarbons (TAH)			
Metals and Cyanide <sup>b</sup>			
Total Suspended Solids (TSS)			
Turbidity		all stations	
Dissolved Oxygen (DO)			
pH			all stations
Temperature			
Salinity			

<sup>a</sup> Non-fixed stations will be sampled following the track of drogues released at the diffuser (outfall station) or at a fixed station having the same depth due north across Knik Arm from Point Woronzof near Point MacKenzie (control station). Three drogue tracks will be made during each of a consecutive flood and ebb tide at the outfall station. Three drogue tracks will be made during a flood tide at the control station in conjunction with or as soon as practicable as the sampling at the outfall station. Stations will include the following along each drogue track: above the diffuser; as close to the ZID boundary as possible; at least one station in the channel in Knik Arm; and the shallow subtidal area (before the drogue grounds).

<sup>b</sup> Metals include arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc; these will be analyzed and reported as total recoverable metals and dissolved metals.

**Table 6. Methods, Preservation, and Maximum Holding Times for the Analysis of Receiving Water Quality Samples.**

Parameter	Method <sup>a</sup>	Preservation	Maximum Holding Time
Fecal Coliform	SM 9221E	Cool, 4°C, dark	24 hours
Color	SM 2120B	Cool, 4°C, dark	48 hours
Total Residual Chlorine (TRC)	SM 4500-Cl D	None	Analyze immediately
Turbidity	SM 2130B	Cool, 4°C, dark	24 hours
Total Aqueous Hydrocarbons (TAqH)	EPA 602 plus xylenes	Cool, 4°C, HCl to pH<2, L- Ascorbic Acid in presence of chlorine	14 days
	EPA 610	Cool, 4°C, dark, L- Ascorbic Acid in presence of chlorine	7 days until extraction/ 40 days after extraction
Total Aromatic Hydrocarbons (TAH)	EPA 602	Cool, 4°C, HCl to pH<2 L- Ascorbic Acid in presence of chlorine	14 days
Metals (Total Recoverable and Dissolved)	See note <sup>b</sup>	Cool, 4°C, HNO <sub>3</sub> to pH <2 (after filtration for dissolved)	28 days
Cyanide	EPA 335.2	NaOH, 4°C	14 days
Total Suspended Solids (TSS)	EPA 160.2	Cool, 4°C	7 days
Dissolved Oxygen (DO)	SM 4500-O G (electrode)	None	<i>in situ</i>
pH	SM 4500-H <sup>+</sup> B	None	<i>in situ</i>
Temperature	SM 2550B <sup>c</sup>	None	<i>in situ</i>
Salinity	SM 2520B <sup>c</sup>	None	<i>in situ</i>

<sup>a</sup> "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020, or 40 CFR 136. "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 20th ed., 1998.

<sup>b</sup> Dissolved metals will be filtered before acidification; total recoverable metals will be digested by ASTM Method D4309-91. Cadmium, chromium, copper, nickel, lead, and zinc will be subject to pre-concentration by chelation following EPA Method 1640 prior to analysis by inductively coupled plasma mass spectroscopy. These metals, along with antimony, beryllium, selenium, and thallium, will be analyzed as total recoverable and dissolved metals as appropriate for ICP/MS (EPA Method 1638). Mercury will be analyzed using cold vapor atomic fluorescence following EPA Method 1631. Arsenic will be determined in all samples by flame ionization atomic spectroscopy (SW846 Method 7062). Silver will be determined by graphite furnace atomic absorption (EPA Method 200.9).

<sup>c</sup> Modified for *in situ* measurements collected with the CTD.

**Table 7. Approximate Locations of Intertidal Bacteria Sampling Stations.**

Station	Station Location Relative to Diffuser	Latitude (N)	Longitude (W)
IT-1	2000 m east	61° 12' 10"	149° 58' 55"
IT-2	1200 m east	61° 12' 11"	149° 59' 50"
IT-3	750 m east	61° 12' 15"	150° 00' 20"
IT-4	250 m east	61° 12' 19"	150° 00' 52"
IT-5	250 m southwest	61° 12' 15"	150° 01' 10"
IT-6	750 m southwest	61° 12' 02"	150° 01' 28"
IT-7	2000 m southwest	61° 11' 22"	150° 02' 02"
IT-C	Across Knik Arm from the diffuser	61° 14' 26"	150° 01' 09"

replicate water samples were collected from each station at slack high water when the water depths were between 1 to 3 feet (ft). Additional quality control samples were collected as described in Section 4.2. Samples were collected by grabbing from 15 - 30 cm depths directly into the appropriate container. Samples were analyzed using the same procedures described above and in Table 6.

In addition to the required intertidal samples, two replicated fecal coliform samples were also collected once during the water quality monitoring effort from three area streams that empty into Knik Arm: Ship, Chester, and Fish Creeks. Samples were analyzed using the same procedures described previously and in Table 6.

At time of collection, all fecal coliform samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.5. All samples were collected in the appropriate precleaned sample containers, dechlorinated, and preserved, if necessary, as described by the method. Samples were placed on gel ice immediately after sampling and remained chilled during transport to the laboratory. Field notes, including navigational and sampling information, were recorded on project-specific field logs. As required by the permit, field observations taken at each station included the presence or absence of floating solids, visible foam in other than trace amounts, oily wastes, or sheen. Weather observations were also recorded. All field documentation was reviewed by the field leader at the completion of the survey. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

### **2.2.3 Vessel Support**

The *NORTH FORTY*, a 26-ft KLI-owned survey vessel, was used for drogue tracking and water sampling in 2004. In addition, a 14-ft Zodiac<sup>®</sup> was used to retrieve grounded drogues and conduct intertidal bacteria sampling. The Zodiac<sup>®</sup> was also used to transport samples with short holding times (i.e., bacterial samples) ashore.

## 2.3 SEDIMENT AND BIOACCUMULATION MONITORING

As stipulated in the NPDES permit, sediment and bioaccumulation monitoring was to be performed during the fourth year after the effective date of the permit. Sampling was to be performed in conjunction with the receiving water sampling. Intertidal and subtidal sediment sampling was performed in conjunction with the 2003 receiving water monitoring sampling. Bioaccumulation sampling was performed during 2004.

### 2.3.1 Bioaccumulation Monitoring

Bioaccumulation monitoring described by the permit was to involve the collection of the intertidal yellow-green algae *Vaucheria* spp. at two intertidal stations (IT-1 and IT-C). At each station, ten replicate samples of the algae were to be collected at randomly-generated distances and bearings within a 10-m radius of the existing station. However, as noted in Section 3.3, bioaccumulation monitoring was scheduled to be performed during 2003, but sufficient accumulations of algae were not present for sample collection. Similar algae conditions were observed in 2004; therefore, in consultation with the AWWU project manager, it was decided and proposed to EPA that either Pacific cod (*Gadus macrocephalus*) or shrimp be collected in the intertidal/subtidal area adjacent to the two intertidal locations to fulfill the permit requirement to conduct a bioaccumulation program. This species substitution was approved by EPA, and the collection of Pacific cod was approved by the Alaska Department of Fish and Game (ADF&G) for the study. The study called for the collection of three to five replicate samples from each location, depending on fish availability. Each replicate consisted of a composite of tissue from a number of fish in order to obtain sufficient biomass for the laboratory analyses. This study was performed in October 2004.

As part of the bioaccumulation monitoring effort and as outlined in Table 8, four replicate Pacific cod (*Gadus macrocephalus*) samples were collected with a beach seine near Point Woronzof (IT-2) and three replicates near the control station near Point MacKenzie (IT-C). It was initially planned to sample at Station IT-1, however a decision was made in the field to relocate the outfall station to Station IT-2 which is located closer to the outfall due to deep mud in the intertidal area and safety concerns with respect to sampling. Replicate fish samples were collected, frozen, and homogenized prior to placing in sample containers. Homogenized fish samples were analyzed for the parameters listed in Table 9.

**Table 8. Approximate Locations of Bioaccumulation Sampling Stations.**

Station Number	Station Location Relative to Diffuser	Latitude (North)	Longitude (West)
Outfall IT-2	Intertidal area 1200 m east of diffuser at Point Woronzof	61° 12' 11"	149° 59' 50"
Control IT-C	Intertidal area near Point MacKenzie directly north across Knik Arm from the diffuser	61° 14' 26"	150° 01' 09"

**Table 9. Preservation and Analytical Procedures for Bioaccumulation Monitoring.**

<b>Parameter</b>	<b>Preservation</b>	<b>Maximum Holding Time</b>	<b>Method<sup>a</sup></b>
Semi-Volatile Organics (including PAHs)	Cool, 4°C	14 days until extraction/40 days after extraction	EPA 8270C/SIM
Pesticides & PCBs	Cool, 4°C	14 days until extraction/40 days after extraction	SW 8081A/8082
Cyanide (total)	Cool, 4°C	14 days	EPA 335.2
Arsenic	Cool, 4°C	6 months	EPA 6020/3050B
Beryllium	Cool, 4°C	6 months	EPA 6020/3050B
Cadmium	Cool, 4°C	6 months	EPA 6020/3050B
Chromium	Cool, 4°C	6 months	EPA 6020/3050B
Copper	Cool, 4°C	6 months	EPA 6020/3050B
Lead	Cool, 4°C	6 months	EPA 6020/3050B
Mercury	Cool, 4°C	6 months	EPA 7471B
Nickel	Cool, 4°C	6 months	EPA 6020/3050B
Selenium	Cool, 4°C	6 months	EPA 6020/3050B
Silver	Cool, 4°C	6 months	EPA 6020/3050B
Zinc	Cool, 4°C	6 months	EPA 6020/3050B
Antimony	Cool, 4°C	6 months	EPA 6020/3050B
Thallium	Cool, 4°C	6 months	EPA 6020/3050B

<sup>a</sup>

Unless otherwise noted, "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd ed., 1986.



At time of collection, fish from each replicate were placed in 5-gallon plastic buckets and frozen whole at KLI's Anchorage office. After thawing, the fish were homogenized using a Kinematic<sup>®</sup> AG homogenizer with a titanium generator. The Kinematic<sup>®</sup> AG homogenizer is designed to prevent contamination by ensuring that sample material only contacts titanium or Teflon<sup>®</sup> parts. The titanium generator and Teflon<sup>®</sup> parts were cleaned prior to the processing of each replicate. After samples were homogenized to a paste-like consistency they were transferred into the appropriate precleaned sample containers, as described by the method. Samples were frozen immediately after sampling and remained frozen during transport to the laboratory. Field notes, including navigational and sampling information, were recorded on a project-specific field logbook. As required by the permit, field observations taken at each station included the presence or absence of floating solids, visible foam in other than trace amounts, oily wastes, or sheen. Weather observations were also recorded. All field documentation was reviewed by the field leader at the completion of the survey. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

### **2.3.2 Vessel Support**

A 16-ft Zodiac<sup>®</sup> was used to support the bioaccumulation monitoring program for the control station performed in 2004. The Point Woronzof bioaccumulation station was accessed from shore.

## **2.4 LABORATORY ANALYSIS**

Laboratory analyses of all samples for this program followed preservation and analysis procedures described by EPA-accepted protocols as referenced in this document (Table 4, Table 6, and Table 9). These procedures are fully described by the referenced documents and/or 40 CFR 136.

## **2.5 DOCUMENTATION PROCEDURES**

All field and sampling data were recorded on appropriate pre-printed project-specific field data forms. Field data forms included drogue tracking forms, water sampling log forms, sample identification/chain of custody forms, and sample labels. These log forms were tailored to the monitoring program to facilitate accurate and complete documentation of field activities. The field task leader was responsible for review and approval of all field documentation; this was completed as soon as possible after sampling.

Sampling logs included specific information such as station identification, sample identification numbers, navigational data, sampling or photographic observations, sampling depths, and collection date and time. Names of personnel performing the sampling were recorded on each log. Drogue tracking logs included station identification information along with navigational data to allow the track of each drogue to be determined and plotted. Pre-printed labels included such information as station designation, analysis type, date of collection, sampling personnel, and a pre-assigned sample identification number to uniquely identify each sample. Quality control samples were labeled as were regular environmental samples so as to be blind to the laboratory analysts.

Sample identification and integrity was ensured by a rigidly-enforced chain of custody program. Sample identification/chain of custody (COC) forms provided specific information concerning the identification, handling, and shipment of samples.

Pertinent information from the sample label was transferred onto the COC, along with other information as required. COC forms were completed, signed by field personnel, and copied if needed. In some cases, where photocopying was not convenient or possible, two-part carbonless forms were used. The original of each COC form was packed with the samples in coolers for shipment to the laboratory. The field task leader retained a copy of each form for the field records and for tracking purposes should a shipment become lost or delayed. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian signed the samples in by checking all sample labels against the COC information and noting any discrepancies as well as sample condition (e.g., containers leaking or damaged during shipment). Internal sample tracking procedures at the laboratory were initiated immediately upon receipt of samples as described by each laboratory's standard operating procedure.

### **3.0 RESULTS**

#### **3.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING**

##### **3.1.1 Monthly Discharge Monitoring Data**

Results of AWWU's daily, weekly, and monthly sampling of influent and effluent for non-metals are presented as monthly summaries in Table 10. Averages and percent removal rates are based on the 12-month period from January through December 2004.

Removal of BOD<sub>5</sub> averaged 35 % for the year, and removal of TSS averaged 79 % for the 12-month reporting period. These averages far exceed the minimum values required by the amendments to the Clean Water Act (40 CFR Part 125.60; Final Rule, 8/9/94), whereby dischargers with 301(h) waivers are required to remove 30 % of BOD<sub>5</sub> and 30 % of the suspended solids. Although not a permit requirement, the removal of BOD<sub>5</sub> was less than this limit on a monthly basis during January. The highest monthly average effluent BOD<sub>5</sub> was 168 mg/L, substantially less than the permit limitation of 240 mg/L. All of the BOD<sub>5</sub> values (daily, weekly, and monthly averages) reported for the calendar year 2004 met the permit limitations. Total suspended solids concentrations in the effluent were low and typical of those seen historically at the Asplund WPCF with the highest monthly average effluent concentration of 51 mg/L compared to the permit limit of 170 mg/L. The yearly TSS average was 49 mg/L. Weekly average and daily maximum TSS also met permit requirements.

The highest mean monthly fecal coliform bacteria count was 1,213 fecal coliform most probable number (FC MPN)/100 mL in August 2004, in excess of the permit limitation of 850 FC MPN/100 mL based on a geometric mean of at least five samples. With the exception of this one month, all other monthly mean values were at or below 617 FC MPN/100 mL, well below the permit limitation. The criterion of not more than 10 % of the samples analyzed should exceed 2,600 FC MPN/100 mL was met during seven months in 2004. This criterion was not met in January (two of 12 samples or 17 %); March (three of 14 samples or 21 %); July (four of 12 samples or 33 %); August (five of 14 of 36 %); and in September (two of 14 samples or 14 %). Exceedances resulted from the continuing adjustment of the Oxidation Reduction Potential chlorine feed control system, optimizing the process to minimize chlorine usage while assuring adequate fecal coliform kill. This chlorine feed control system is discussed below in Section 5.1.1. All fecal coliform exceedances were reported to EPA on the discharge monitoring reports (DMRs) as required. No other permit exceedances were noted.

The TRC daily maximum limit fell below the permit-required limitation of 1.2 mg/L this year, with a maximum daily value of 1.0 mg/L. The monthly averages of TRC concentrations ranged from 0.10 to 0.49 mg/L, with an overall average of 0.26 mg/L. The permit requirement that effluent pH remain between 6.5 and 8.5 standard units was always met, exhibiting a minimum and maximum range of 6.6 to 8.1 pH units for the year.

Although other parameters such as DO, temperature, and ammonia do not have permit limitations, ranges were typical of those seen historically. DO in effluent exhibited monthly averages ranging from 2.1 to 5.2 mg/L, with a yearly average of 3.9 mg/L. Temperature showed yearly averages of 12.9 and 13.6°C in the influent and effluent, respectively. Monthly values for total ammonia in effluent ranged from 17.2 to 24.2 mg/L, with a yearly average of 20.9 mg/L.

**Table 10. Discharge Monitoring Data for Influent and Effluent Non-Metals.**

Month	Average Flow Rate (MGD)	Temperature Average (°C)		pH Minimum/Maximum (pH)		TRC Average (mg/L)		DO Average (mg/L)		BOD <sub>5</sub> Average (mg/L)		Total Susp. Solids Average (mg/L)		Fecal Coliform Average (MPN/100 mL)		Total Ammonia (mg/L)	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF
01/04	28.0	11.4	12.0	7.1/7.7	6.9/7.7	NT	0.18	NT	4.8	237	168	205	45	NT	617	NT	21.6
02/04	27.7	11.0	11.6	6.9/7.6	6.8/7.4	NT	0.2	NT	4.2	238	162	217	48	NT	168	NT	20.9
03/04	28.1	11.2	11.7	7.0/8.0	6.8/7.6	NT	0.33	NT	4.0	241	162	234	49	NT	131	NT	24.2
04/04	34.3	10.6	11.2	6.9/7.7	6.7/7.6	NT	0.3	NT	4.7	205	136	204	50	NT	142	NT	17.2
05/04	30.1	11.8	12.6	6.9/7.6	6.8/7.4	NT	0.2	NT	3.9	212	135	235	49	NT	189	NT	22.6
06/04	27.6	13.6	14.4	6.8/7.8	6.6/8.1	NT	0.1	NT	3.2	237	156	248	49	NT	335	NT	24.0
07/04	26.2	15.3	16.5	6.9/7.5	6.8/7.3	NT	0.1	NT	2.1	259	161	259	50	NT	514	NT	22.5
08/04	26.8	16.2	17.2	6.7/7.6	6.9/7.7	NT	0.12	NT	2.1	251	152	280	50	NT	1213	NT	21.5
09/04	30.3	15.4	16.1	7.1/7.5	7.0/7.5	NT	0.33	NT	3.3	210	136	228	51	NT	123	NT	19.6
10/04	31.3	14.0	14.4	7.1/7.4	7.0/7.4	NT	0.29	NT	4.3	211	133	212	51	NT	295	NT	18.6
11/04	29.9	12.7	13.7	7.1/7.7	7.0/7.4	NT	0.44	NT	5.0	206	136	212	49	NT	118	NT	17.9
12/04	29.7	11.5	12.3	7.0/7.7	6.9/7.5	NT	0.49	NT	5.2	206	139	214	50	NT	57	NT	19.7
<b>Average</b>	29.2	12.9	13.6	6.7/8.0 <sup>a</sup>	6.6/8.1 <sup>a</sup>	---	0.26	---	3.9	226	148	229	49	---	325	---	20.9
<b>Percent Removal</b>	---	---	---	---	---	---	---	---	---	35	79	---	---	---	---	---	---

<sup>a</sup> Yearly (minimum-maximum)

NT Not tested (tested in effluent only)

--- Not applicable

### 3.1.2 Toxic Pollutants and Pesticides Analyses

Toxic pollutant and pesticide monitoring for influent, effluent, and sludge was conducted on 23 - 24 June 2004 for summer-dry weather and 23 - 24 August 2004 for the summer-wet sampling. Sampling was performed over a 24-hr period by AWWU personnel.

Results of the toxic pollutant and pesticide analyses are provided in Table 11 (June 2004) and Table 12 (August 2004). For semi-volatile organic compounds (EPA Methods 625/8270C), volatile organic compounds (EPA Methods 624/8260B), and pesticides (EPA Methods 608/8081A and 614/8141A), only those pollutants that were detected in the influent, effluent, or sludge are listed. Refer to Appendices A and B for a complete listing of toxic pollutants and pesticides analyzed. A number of the constituents were found only in the sludge. Pollutants found in the influent were often detected in the effluent, and vice versa. In general, pollutant concentrations were low and many of the concentrations reported for the two samplings were below method detection limits (MDLs) or method reporting limits (MRLs).

Percent removal rates shown in these tables were computed from influent and effluent concentration values. Percent removal was only calculated for compounds where a concentration in the influent and/or effluent was reported at a level above the MDL or MRL. Compounds with estimated concentrations (denoted with a "J" qualifier) were not used for percent removal calculation unless a non-estimated concentration was reported for that compound in the other type of sample (influent or effluent). The reported MDL or MRL was used for calculations where necessary (where a compound was reported as non-detect [ND]). Where several laboratory duplicate analyses were performed for a parameter, a percent removal is provided for each duplicate. For summed values, such as the total aromatic hydrocarbons as BETX, the MRL or MDL was used for values reported as not detected (ND).

Some of the pollutant removal rates were actually negative values due to the higher concentrations found in the effluent or where a compound was detected in the effluent but not the influent. Both positive and negative removals can be caused by effluent samples being more homogenous due to mixing in the clarifiers, whereas detecting a point-source pollutant in the influent is more variable. Also, there is a residence time for the effluent in the plant, along with the addition of approximately 1 million gallons/day of well water and city water in the treatment process, therefore the influent does not correspond directly with the effluent.

The types and concentrations of measured organic compounds varied considerably between the two sampling periods. Compounds that were detected in both the influent and effluent samples during at least one of the sampling events included bis (2-ethylhexyl) phthalate, butyl benzyl phthalate, di-n-butyl phthalate, diethyl phthalate, phenol, chloroform, methylene chloride, and toluene. Many of these compounds were estimated values that were below their reporting limits and therefore were qualified with a J. Methylene chloride was seen in the method blank in August 2004. This compound is a common laboratory contaminant that has been noted in the past (see Section 4); these data were appropriately qualified with a B indicating potential laboratory contamination. Although not detected in the method blanks, phthalate compounds are another common laboratory contaminant that were seen in the influent and effluent. Compounds that were detected in the sludge during the June 2004 sampling included benzene, ethylbenzene, tetrachloroethene, toluene, xylene, 1,4-dichlorobenzene, and bis (2-ethylhexyl) phthalate. In August 2004, of those compounds that were detected in both the influent and effluent,

**Table 11. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 23 - 24 June 2004.**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>VOLATILES (EPA Methods 624/SW 8260B) – detected substances only</b>				
Benzene	ND (5.0)	ND (5.0)	0.014 J	---
Chloroform	2.5 J	3.2 J	ND (0.079)	---
Ethylbenzene	ND (5.0)	ND (5.0)	0.15	---
Methylene Chloride	2.4 J	4.4 J	ND (0.16)	---
Tetrachloroethene	ND (5.0)	ND (5.0)	0.16	---
Toluene	6.2	5.9	0.63	4.8
Xylenes (total)	ND (10)	ND (10)	0.79	---
1,4- Dichlorobenzene	ND (5.0)	ND (5.0)	0.29	---
<b>SEMI-VOLATILES (EPA Methods 625/SW 8270C) – detected substances only</b>				
Bis (2-ethylhexyl) phthalate	12	16	18 J	-33
Butyl benzyl phthalate	2.1 J	ND (10)	ND (66)	---
Di-n-butyl phthalate	1.5 J	1.7 J	ND (66)	---
Diethyl phthalate	8.5 J	8.5 J	ND (66)	---
Phenol	30	19	ND (66)	37
<b>HYDROCARBONS</b>				
Oil & Grease (EPA 1664-HEM)	40300	26300	NT	35
Total Aromatic Hydrocarbons as BETX from EPA Method 624	26.2	25.9	1.58	1.1

**Table 11. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 23 - 24 June 2004. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>DISSOLVED METALS</b>				
Antimony	ND (1.0)	ND (1.0)	NT	---
Arsenic	ND (<2)	ND (<2)	NT	---
Beryllium	ND (<0.1)	ND (<0.1)	NT	---
Cadmium	ND (<0.3)	0.6	NT	-100
Chromium	ND (<1)	ND (<1)	NT	---
Copper	16	27	NT	-69
Lead	10	4	NT	60
Mercury	ND (<0.06)	ND (<0.06)	NT	---
Nickel	4	6	NT	-50
Selenium	ND (1.0)	ND (1.0)	NT	---
Silver	ND (<0.3)	ND (<0.3)	NT	---
Thallium	ND (1.0)	ND (1.0)	NT	---
Zinc	40	40	NT	0
<b>TOTAL METALS</b>				
Antimony	1.1	ND (1.0)	2.46	9
Arsenic	2	ND (<2)	3.3	0
Beryllium	0.2	0.2	0.18	0
Cadmium	ND (<0.3)	ND (<0.3)	1.81	---
Chromium	5	4	16.6	20
Copper	76	63	253	17
Lead	12	12	28.3	0
Mercury	0.41	0.11	1.12	73
Nickel	7	5	13.2	29
Selenium	ND (1.0)	ND (1.0)	2.71	---
Silver	5.6	3.9	15.7	30
Thallium	ND (1.0)	ND (1.0)	ND (0.882)	---
Zinc	180	140	469	22

**Table 11. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 23 - 24 June 2004. (continued)**

Pollutant	Influent <sup>a</sup> (µg/L)	Effluent <sup>a,b</sup> (µg/L)	Sludge <sup>a</sup> (µg/g)	Percent Removal
<b>PESTICIDES (EPA Methods 608/SW 8081A/8082, 614/SW 8141A) – No substances detected</b>				
<b>ENTEROCOCCI BACTERIA (SM 9230B)</b>				
Enterococci <sup>c</sup>	NT	2200 / 2700	NT	---
<b>OTHER COMPONENTS</b>				
Asbestos <sup>d</sup>	ND (<7.10)	ND (<14.00)	ND	---
Cyanide	ND (<10)	ND (<10)	0.17	---
Dioxin (2,3,7,8-TCDD )	ND (0.00012)	ND (0.00047)	ND (0.000067)	---

- a* Detection limits or reporting limits are included in parentheses for non-detected (ND) values  
*b* Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)  
*c* Enterococci reported in MPN/100 mL  
*d* Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)  
J Below MDL or MRL (estimated value)  
--- Not applicable (not calculated)  
ND None detected  
NT Not tested



**Table 12. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 23- 24 August 2004.**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>VOLATILES (EPA Methods 624/ SW8260B) – detected substances only</b>				
Benzene	ND (5.0)	ND (5.0)	ND (0.084)	---
Chloroform	2.7 J	3.6 J	ND (0.084)	---
1, 4-Dichlorobenzene	ND (5.0)	ND (5.0)	0.420	---
Ethylbenzene	ND (5.0)	ND (5.0)	0.099	---
Methylene chloride	4.2 B,J	4.7 B,J	ND (0.170)	---
Tetrachloroethene	8.3	ND (5.0)	0.096	40
Toluene	7.1	7.2	1.8	-1.4
Xylenes (total)	ND (10)	ND (10)	0.510	---
<b>SEMI-VOLATILES (EPA Methods 625/ SW8270C) – detected substances only</b>				
Benzo (g,h,i) perylene	ND(10)	ND(10)	7.6 J	---
Bis (2-ethylhexyl) phthalate	15	15	25	0
Butyl benzyl phthalate	5.6 J	4.2 J	10	---
1,4- Dichlorobenzene	1.1 J	ND(10)	ND(10.0)	---
Dibenz (a, h) anthracene	ND(10)	ND(10)	5.7 J	---
Di-n-butyl phthalate	ND(10)	ND(10)	4.5 J	---
Di-n-octyl phthalate	ND(10)	ND(10)	5.1 J	---
Diethyl phthalate	7.9 J	7.4 J	ND(10.0)	---
Indeno (1,2,3-cd) pyrene	ND(10)	ND(10)	4.7 J	---
Phenol	31	19	ND(10.0)	39
Pyrene	ND(10)	ND (10)	2.1 J	---
<b>HYDROCARBONS</b>				
Oil & Grease (EPA 1664-HEM)	53300	25400	NT	52
Total Aromatic Hydrocarbons as BETX from EPA Method 624	27.1	27.2	NT	-0.4

**Table 12. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 23-24 August 2004. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>DISSOLVED METALS</b>				
Antimony	ND (10)	ND(10) / ND(10)	NT	---/---
Arsenic	ND (<2.0)	ND (<2.0)	NT	---
Beryllium	ND(<0.1)	0.1	NT	0
Cadmium	ND(<6.2)	ND(<6.2)	NT	---
Chromium	ND(<6.2)	ND(<6.2)	NT	---
Copper	14	49	NT	-250
Lead	3	8	NT	-167
Mercury	ND (<0.06)	ND (<0.06)	NT	---
Nickel	ND(<6.2)	ND(<6.2)	NT	---
Selenium	ND (10)	ND (10) / ND (10)	NT	---/---
Silver	0.7	0.6	NT	14
Thallium	ND (10)	ND(10)/ND(10)	NT	---/---
Zinc	152	12	NT	92
<b>TOTAL METALS</b>				
Antimony	ND (10)	ND (10) / ND (10)	2.32	---/---
Arsenic	ND (<2.0)	ND (<2.0)	2.8	---
Beryllium	0.2	0.1	0.15	50
Cadmium	ND(<6.2)	ND(<6.2)	3	---
Chromium	ND(<6.2)	ND(<6.2)	12	---
Copper	85	65	263	24
Lead	6	4	19.8	33
Mercury	0.17	0.70	1.57	-312
Nickel	ND(<6.2)	ND(<6.2)	15	---
Selenium	ND (10)	ND (10) / ND (10)	2.83	---/---
Silver	ND (<1.5)	ND (<1.5)	1.92	---
Thallium	ND (10)	ND (10) / ND (10)	ND (0.952)	---/---
Zinc	165	76	492	54

**Table 12. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 23–24 August 2004. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>PESTICIDES (EPA 608/SW8081A, SW8082, 614/SW8141A) – detected substances only</b>				
Malathion	0.10 J, COL	ND (1.2)	ND (0.038)	---
<b>ENTEROCOCCI BACTERIA (SM 9230B)</b>				
Enterococci <sup>c</sup>	NT	2400 / 2400	NT	---
<b>OTHER COMPONENTS</b>				
Asbestos <sup>d</sup>	ND (<210.00)	ND (<210.00)	ND	---
Cyanide	ND (<10)	ND (<10)	ND (<0.2)	---
Dioxin (2,3,7,8-TCDD)	ND (0.00013)	ND (0.00011)	ND(0.000052)	---

*a* Detection limits or reporting limits are included where possible in parentheses for non-detected (ND) values

*b* Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)

*c* Enterococci reported in MPN/100 mL

*d* Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)

--- Not applicable (not calculated)

B Also detected in associated method blank or field blank

COL More than 40 % RPD between primary and confirmation columns results. The lower of the two results is reported

J Below MDL or MRL (estimated value)

ND None detected

NT Not tested

only toluene, bis (2-ethylhexyl) phthalate, and butyl benzyl phthalate were seen in the sludge. In addition, 1,4-dichlorobenzene, ethylbenzene, tetrachloroethene, xylenes, benzo (g,h,i) perylene, dibenz (a,h) anthracene, di-n-butyl phthalate, di-n-octyl phthalate, indeno (1,2,3-cd) pyrene and pyrene were also detected in the sludge in August 2004.

Oil and grease concentrations measured in the influent and effluent in 2004 using EPA 1664 HEM were slightly higher than that seen in the past with effluent concentrations in the range of 25-26 mg/L. Effluent BETX concentrations as measured by EPA 624 were 25.9 and 27.2 µg/L in the summer dry and summer wet sampling, respectively. Total aromatic hydrocarbons as BETX (EPA 602) and PAHs were also sampled in the effluent as part of the receiving water program. Refer to Sections 5.1 and 5.2 for further discussion of the significance of the total hydrocarbon values.

The AWQS have site-specific criteria for the Point Woronzof area that are based on dissolved metals in the receiving water. These SSWQC were utilized to determine the MAEC (defined as the value specified as the receiving water limit and/or the permit limit multiplied by the initial dilution of 142:1 for conservative substances and 180:1 for non-conservative substances after taking into account the natural background concentration). Both total and dissolved concentrations of metals in the effluent were then compared to the MAECs.

Total metals concentrations in the influent and effluent were generally found to be low. Influent and effluent concentrations of total cadmium, selenium, and thallium were below detection limits during both sampling periods. Total antimony and arsenic were seen at low levels in the influent during the June sampling, but were not seen in the effluent in June or during the August sampling. Total chromium, nickel, and silver were seen at low levels in both the influent and effluent during the June sampling, but were not detected during the August sampling event. Total beryllium was reported at low levels during both sampling periods in both influent and effluent. Other total recoverable metals such as copper, lead, mercury, and zinc were seen in the influent and effluent during both sampling events, but at very low levels when compared to their respective MAECs.

Dissolved metals concentrations were also generally found to be low. Dissolved antimony, arsenic, chromium, mercury, selenium, and thallium were found to be below detection limits for both influent and effluent during both sampling periods. Dissolved copper, lead, and zinc were above detection limits in both influent and effluent during both sampling events, while dissolved silver was reported at low levels for both influent and effluent during the August 2004 sampling period but were below detection limits in the June 2004 sampling. Dissolved nickel was reported below detection limits in the August 2004 sampling and at low levels during the June 2004 sampling. Dissolved beryllium was reported at low levels in the effluent only during the August 2004 sampling, while dissolved cadmium was seen in the effluent only during June 2004 at low levels. The concentration for dissolved copper in effluent was found to be the highest of any of the metals with respect to its MAEC of 317 µg/L, with levels of 27 µg/L (June 2004) and 49 µg/L (August 2004), still approximately an order of magnitude less than the MAEC.

No pesticides were detected in the influent, effluent, or sludge during the June 2004 sampling event. Malathion was estimated at level below the MDL (therefore qualified with a J) in the influent but not in the effluent or sludge during August 2004. For a complete list of the various pesticide analytes, refer to Appendices A3 and B3.

The permit calls for the analysis of enterococci bacteria in effluent twice per year in conjunction with the summer dry and summer wet sampling. The enterococci in the effluent was reported as 2,200 and 2,700 most probable number (MPN)/100 mL for the June 2004 sampling and 2,400 MPN/100 mL for both of the replicates taken during the August 2004 sampling event.

Asbestos was not detected in influent, effluent, or sludge during either sampling event. The concentrations of cyanide in influent and effluent were less than the detection limit of 10 µg/L during both the June and August 2004 sampling events as compared to an MAEC of 181 µg/L. Cyanide was detected in sludge at 0.17 in June 2004, but not in the August 2004 sampling event. Dioxins (2,3,7,8-TCDD) were tested in influent, effluent, and sludge during both sampling events, but none were detected.

### **3.1.3 Pretreatment Monitoring Data**

As part of the NPDES permit, AWWU is to conduct pretreatment monitoring twice per year in conjunction with the toxic pollutant and pesticide analyses. This monitoring includes three consecutive days of 24-hr composite sampling of the influent and effluent. Pretreatment analyses include cyanide and a suite of metals that are analyzed as both total and dissolved. Results of the pretreatment monitoring are presented in Table 13.

Collection of samples for metals analysis as part of the toxic pollutant and pesticide sampling events in June and August 2004 coincided with the first day of the pretreatment monitoring performed by the Asplund WPCF during 2004. These metals concentrations were discussed in Section 3.1.2. Metals concentrations for the two additional days of each 3-day pretreatment sampling event were typically similar to those discussed above, particularly for the effluent. For example, dissolved copper in the effluent was reported at 27 µg/L during the first day of pretreatment sampling in June 2004 and at 31 and 27 µg/L on the other two days of sampling. Dissolved copper in the effluent during the August 2004 pretreatment sampling was reported at 49, 55, and 45 µg/L. Influent values were typically more variable than those seen in effluent, as would be expected.

Of all the metals in the effluent, dissolved and total copper and zinc concentrations were the highest, but values for these metals were still well below their respective MAECs. Dissolved copper in the effluent was found to range from 27 to 55 µg/L for the six pretreatment samples, as compared to the MAEC of 317 µg/L. Total copper in the effluent ranged from 59 - 68 µg/L during the pretreatment sampling. Dissolved zinc in the effluent ranged from 12 - 60 µg/L during both pretreatment samplings, while total zinc ranged from 76 to 150 µg/L as compared to an MAEC of 11,249 µg/L. Dissolved mercury was reported at <0.06 µg/L, and total mercury ranged from 0.11 to 0.70 µg/L in all six effluent samples, as compared to the MAEC of 2.73 µg/L. Other metals were also found to be substantially less than their respective MAECs. Total cyanide was below detection limits (<10 µg/L) in five of the six effluent samples collected. The sample collected on the second day of the August 2004 pretreatment sampling exhibited a cyanide concentration of 10 µg/L compared to an MAEC of 181 µg/L.

### **3.1.4 Whole Effluent Toxicity Testing Results**

Quarterly WET testing was conducted on 24-hr flow composite effluent samples as required under the permit during all four quarters of calendar year 2004. Bivalve survival and

**Table 13. Pretreatment Monitoring Data for Influent and Effluent Metals and Cyanide.**  
Concentrations are in µg/L.

Parameter	June 2004						August 2004					
	Influent			Effluent			Influent			Effluent		
Sample Date	23	24	25	23	24	25	23	24	25	23	24	25
<b>Dissolved Metals</b>												
Arsenic	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Beryllium*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Cadmium	<0.3	<0.3	<0.3	0.6	0.3	0.3	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
Chromium	<1	<1	<1	<1	<1	<1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
Copper	16	17	13	27	31	27	14	20	17	49	55	45
Cyanide	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Lead	10	2	3	4	2	2	3	5	6	8	4	5
Mercury	<0.06	0.07	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Nickel	4	9	6	6	7	4	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
Silver	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.7	0.5	0.4	0.6	0.5	0.3
Zinc	40	20	30	40	60	60	152	79	21	12	35	41
<b>Total Metals</b>												
Arsenic	2	<2	3	<2	<2	2	<2	<2	4	<2	<2	2
Beryllium*	0.2	0.2	0.1	0.2	0.3	0.1	0.2	0.2	0.2	0.1	0.2	0.2
Cadmium	<0.3	0.6	0.3	<0.3	<0.3	<0.3	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
Chromium	5	5	6	4	3	4	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
Copper	76	77	71	63	68	59	85	87	99	65	46	46
Cyanide	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	<10
Lead	12	8	11	12	6	5	6	10	11	4	4	5
Mercury	0.41	0.86	0.53	0.11	0.31	0.18	0.17	0.19	0.07	0.70	0.10	0.06
Nickel	7	8	7	5	5	4	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
Silver	5.6	7.2	5.0	3.9	2.6	3.0	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Zinc	180	160	140	140	150	140	165	177	192	76	95	119

\* Not required by permit

NT Not tested

development tests were performed using the mussel *Mytilus galloprovincialis* during the first, second, and third quarters of 2004. Use of this test was based on the screening test results from the third quarter of 2003, which had determined the mussel to be the most sensitive species tested (see Section 2.1.4). Re-screening for the most sensitive species was performed again in 2004 during the fourth quarter.

Results of all the tests performed in 2004 are summarized below and presented in Table 14 as the lowest observed effect concentration (LOEC), no observed effect concentration (NOEC), and in chronic toxicity units (TUC), where TUC = 100/NOEC. Detailed results in the form of descriptive laboratory reports that present all data in tabular form along with statistical analyses, QA/QC information, and reference toxicant tests have previously been submitted to EPA with the monthly DMRs and are presented in Appendix C.

**Table 14. Summary of WET Test Data from 2004.**

Toxicity Test	LOEC (%)	NOEC (%)	TUC
<b>1<sup>st</sup> Quarter 2004</b>			
Bivalve (survival)	>2.8	2.8	≤35.7
Bivalve (development)	>2.8	2.8	≤35.7
<b>2<sup>nd</sup> Quarter 2004</b>			
Bivalve (survival)	>2.8	2.8	≤35.7
Bivalve (development)	>2.8	2.8	≤35.7
<b>3<sup>rd</sup> Quarter 2004</b>			
<b>Bivalve (survival)</b>	<b>2.8</b>	<b>1.4</b>	<b>71.4</b>
<b>Bivalve (development)</b>	<b>2.8</b>	<b>1.4</b>	<b>71.4</b>
<b>4<sup>th</sup> Quarter 2004</b>			
Bivalve (survival)	>2.8	<u>2.8</u>	<u>35.7</u>
Bivalve (development)	>2.8	<u>2.8</u>	<u>35.7</u>
Topsmelt (survival)	>2.8	<u>2.8</u>	<u>35.7</u>
Topsmelt (growth)	>2.8	<u>2.8</u>	<u>35.7</u>
Echinoderm (fertilization)	<b>1.4</b>	<b><u>0.7</u></b>	<b><u>142.9</u></b>

*Bolded values indicate statistically significant results indicating chronic toxicity.*

First quarter 2004 bivalve survival and development testing was performed on a single 24-hr composite sample collected on 2 - 3 February 2004. Sampling for the second quarter testing with bivalves was performed on 5 - 6 April 2004. Third quarter testing with bivalves was performed on an effluent sample collected from 26 - 27 July 2004. Fourth quarter samples for re-screening for species sensitivity using bivalve survival and development, topsmelt larval survival and growth, and echinoderm fertilization testing were collected from 24 - 29 October 2004.

Results of the first and second quarterly 2004 bivalve testing showed that no concentration of effluent tested produced significant mortality or significant decreased normal development of test organisms when compared to the controls. Results reported for these tests showed an LOEC of  $>2.8\%$ , an NOEC of  $2.8\%$ , and a TUC of  $\leq 35.7$  for both survival and development. All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicated typical sensitivity of the test populations for these tests.

Results of the third quarter 2004 bivalve testing showed significantly reduced survival and normal development of the test organisms at the highest test concentration. The LOEC for both survival and normal development was  $2.8\%$ , while the NOEC for survival and normal development was  $1.4\%$ . The TUC for both survival and development was 71.4, well below the permit maximum of 143.

Bivalve testing performed during the re-screening testing done during the fourth quarter of 2004 showed that no effluent test concentration produced a significant mortality or a decrease in normal development when compared to the controls. Results for these tests showed an LOEC of  $>2.8\%$ , an NOEC of  $2.8\%$ , and a TUC of 35.7 for both survival and development. All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicated typical sensitivity of the test populations for this test.

Results of the topsmelt larval survival and growth testing performed during re-screening in the fourth quarter of 2004 showed that no effluent test concentration produced a significant mortality or a decrease in growth when compared to the controls. The LOEC for both survival and growth was  $>2.8\%$ , the NOEC was  $2.8\%$ , and the TUC was 35.7. All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicated typical sensitivity of the test populations for this test.

Results of the echinoderm fertilization test conducted during the re-screening performed in the fourth quarter of 2004 showed that the two highest concentrations of effluent tested produced a significant decrease in egg fertilization compared to the controls. The LOEC was  $1.4\%$  and the NOEC was  $0.7\%$ , with a TUC of 142.9, just under the permit maximum of 143. All test validity criteria were met and reference toxicant tests were within laboratory control chart limits which indicated typical sensitivity of the test populations for this test. Based on these results, WET testing in 2005 will be conducted using the echinoderm test as it was determined to be the most sensitive during the 2004 three-species WET test re-screening.

### **3.1.5 Part 503 Sludge Monitoring Data**

The AWWU operates a sludge incinerator at the Asplund WPCF for which the NPDES permit requires sludge monitoring twice per year as part of the "Toxic Pollutants and Pesticides/Pretreatment" sampling requirements. As described in Section 2.1.5, AWWU performed Part 503 sludge monitoring with a minimum frequency of once every 60 days. These data will be submitted along with other incinerator operational information to EPA by 19 February 2005. This submittal will take the form of a separate report; however, for completeness and for comparison purposes, this information has been included here as well.

Results of the sludge monitoring for metals for the year are presented in Table 15. Metals concentrations were extremely low compared to allowable limits and very similar to those seen



**Table 15. Part 503 Discharge Monitoring Data for Sludge Metals.** Concentrations are in mg/kg dry weight. All metals are reported as total metals.

Parameter	Arsenic	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel
MDL	0.3	0.02	0.05 <sup>b</sup>	2/0.2 <sup>b</sup>	0.2	0.06 <sup>e</sup>	3/0.2 <sup>b</sup>
Permit Limit <sup>a</sup>	95.8	500 <sup>c</sup>	66.6	2,466	7,707	9.63 <sup>d</sup>	102,764
02/02/04	2.5	0.11	1.32	11.5	21.2	1.04 <sup>e</sup>	9.1
04/05/04	2.5	0.16	2.08	14.3	30.1	2.06	11.4
06/23/04	3.3	0.18	1.81	16.6	28.3	1.12	13.2
08/23/04	2.8	0.15	3.00	12.0 <sup>b</sup>	19.8	1.57	15.0
10/07/04	3.8	0.14	1.74	20.6	25.5	0.71	17.2
12/02/04	2.9	0.11	1.46	19.4	28.3	1.40	17.1
MINIMUM	2.5	0.11	1.32	11.5	19.8	0.71	9.1
MAXIMUM	3.8	0.18	3.00	20.6	30.1	2.06	17.2
AVERAGE	3.0	0.14	2	16	25.5	1.32	14

Footnotes:

MDL Method detection limit

<sup>a</sup> Permit Allowable Limits calculated in *Air Operating Permit Application* submitted to ADEC, December 1997 (CH2M Hill, 1997).

<sup>b</sup> Cadmium, chromium, and nickel were analyzed by the EPA 7130, 7190 and 7520 methods, respectively, on the 8/23/04 samples only.

<sup>c</sup> Beryllium emissions shall not exceed 10 grams per day. With a control efficiency of 0.9998 at the maximum sludge feed rate, a sludge concentration of 500 milligrams per dry kilogram of sludge will not result in a violation of the limit.

<sup>d</sup> Mercury emissions shall not exceed 3,200 grams per day. With a control efficiency of 0.0 at the maximum sludge feed rate, a sludge concentration of 9.63 milligrams per dry kilogram of sludge will not result in a violation of the limit.

<sup>e</sup> The February 2004 Hg analysis was performed by a contract lab. The test PQL was 0.123 mg/kg.

historically. The only metal that had historically been elevated for some sampling events was arsenic. In 2004, the highest concentration of arsenic in the sludge was 3.8 mg/kg compared to the allowable limit of 95.8 mg/kg. As mentioned above, no actual limits exist in the reissued NPDES permit. Allowable limits are site-specific and were calculated per Part 503 regulations in the *Air Operating Permit Application* submitted by AWWU to the ADEC in December 1997 (CH2M Hill, 1997).

### **3.2 RECEIVING WATER QUALITY MONITORING RESULTS**

Water quality sampling of the receiving water was conducted on 23 - 24 June 2004, concurrent with the summer dry sampling. Sampling results are contained in the following subsections.

#### **3.2.1 Plume Dispersion Sampling**

##### **Drogue Tracking Results**

Drogues were released on 23 June 2004 at the ZID station for the ebb and flood tidal cycles and on 24 June 2004 at the control station for the flood tidal cycle. Three drogues were deployed during each tidal cycle.

##### **ZID Site**

The Point Woronzof ebb drogue drop and tracking cycles were performed during the afternoon of 23 June 2004. The tidal range during ebb stage was 24.0 feet (Figure 5 and Table 16; Micronautics, Inc. Tide 1: Rise and Fall®, 2004). A composite of the ebb drogue deployments is depicted in Figure 6.

The ebb drogues traveled from approximately 2 to 3 nautical miles, all three traveling in a southwesterly direction. No eddies were observed during these drogue tracks, nor did any of the drogues become grounded during their tracks. The first ebb (E1) drogue was released at 11:35 Alaska Daylight Time (ADT), about ½ hour after high tide. This drogue tracked west-southwest and well south of the shoal that is evident at low water approximately one mile southwest of Point Woronzof. This drogue traveled at approximately 84 centimeters per second (cm/s) over its entire track of about 2 nautical miles. The second ebb drogue (E2) was released at 13:12 ADT and tracked along an almost identical track as the first drogue, well south of the shoal, traveling nearly 2½ nautical miles with an average speed of 86 cm/s over the entire track. The third drogue (E3) was released at 14:50 ADT. This drogue again followed a similar path to the first two drogues traveling in a west southwesterly direction. This drogue traveled over 3 nautical miles at approximately 85 cm/s over its entire track.

Flood drogue tracks are depicted in Figure 7. The tidal range during flood stage was 25.7 feet (Figure 5 and Table 16; Micronautics, Inc. Tide 1: Rise and Fall®, 2004). The first flood drogue (F1) was deployed on 23 June at 18:26 ADT at low slack water at the outfall and tracked until 19:45 ADT, at which point it was recovered. This drogue traveled easterly along the shoreline on the lee side of Point Woronzof for over 2 nautical miles. The drogue traveled at an average speed of approximately 61 cm/s. The second flood drogue (F2) was deployed at 20:06 ADT, almost 2 hours after low slack. This drogue was transported to the east for about 1½ nautical miles and then slowly looped in an eddy toward shore, finally traveling southwest for about ¼

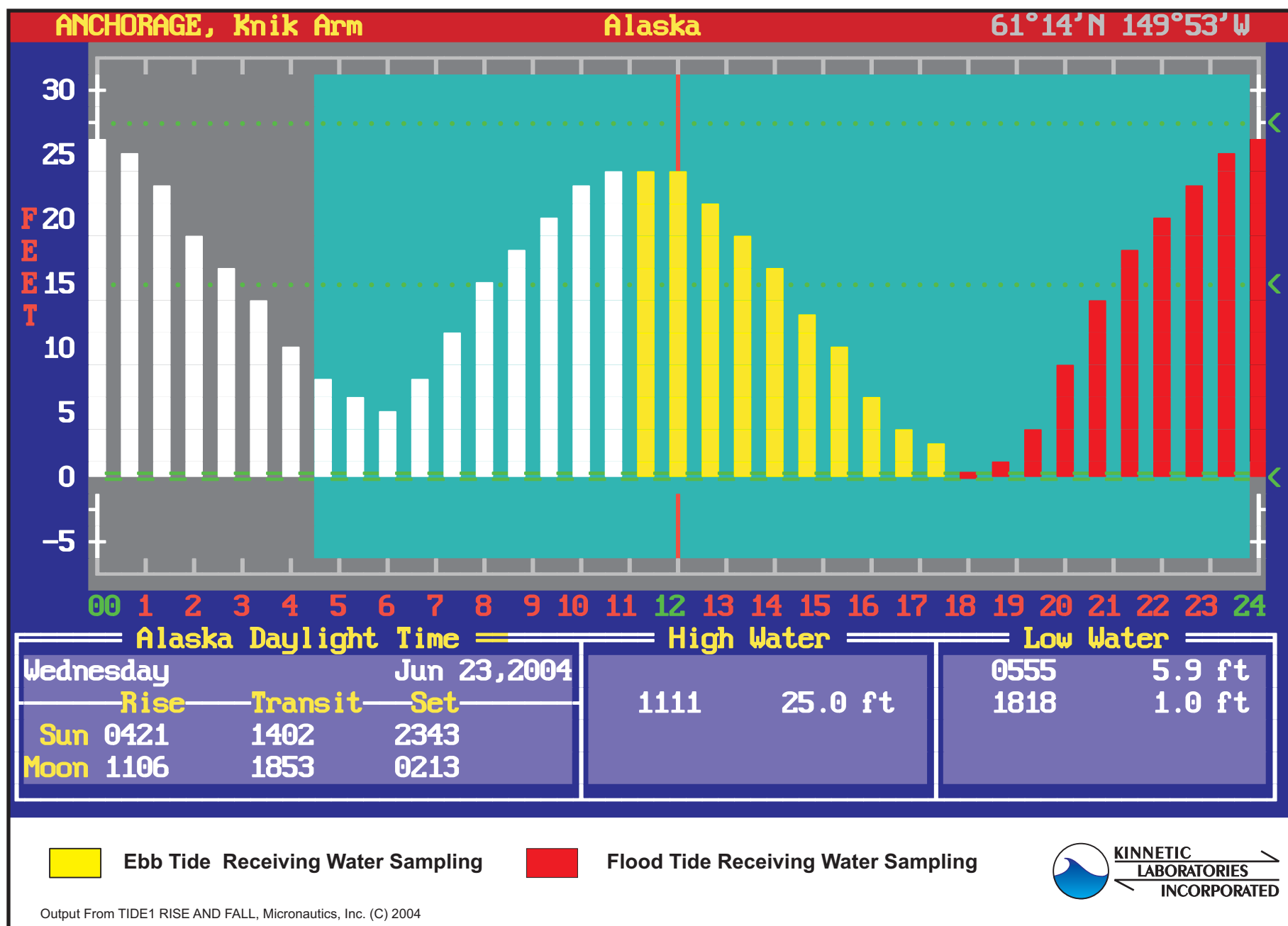


Figure 5. Tidal Information for Receiving Water Sampling, Ebb and Flood Tides.

**Table 16. 2004 Drogue Tracking Information.**

DATE	STATION	TIDAL INFORMATION				DROGUE NO.	RELEASE TIME AFTER SLACK (HOURS:MINUTES)	DROGUE SPEED (CM/S)
		Slack Water (Alaska Daylight Time <sup>a</sup> ; Stage)		Direction	Range (Feet) <sup>b</sup>			
23 June 2004	ZID	11:11	HIGH	EBB	24.0	E1	0:24	84
23 June 2004	ZID	11:11	HIGH	EBB	24.0	E2	2:01	86
23 June 2004	ZID	11:11	HIGH	EBB	24.0	E3	3:39	85
23 June 2004	ZID	18:18	LOW	FLOOD	25.7	F1	0:08	61
23 June 2004	ZID	18:18	LOW	FLOOD	25.7	F2	1:48	59
23 June 2004	ZID	18:18	LOW	FLOOD	25.7	F3	3:28	102
24 June 2004	CONTROL	18:56	LOW	FLOOD	24.3	C1	- 0:11	102
24 June 2004	CONTROL	18:56	LOW	FLOOD	24.3	C2	1:58	212
24 June 2004	CONTROL	18:56	LOW	FLOOD	24.3	C3	3:22	364

<sup>a</sup> Tide1: Rise and Fall®, Micronautics, Inc. 2004. (Knik Arm, Anchorage)

<sup>b</sup> Predicted water level variations during tide.

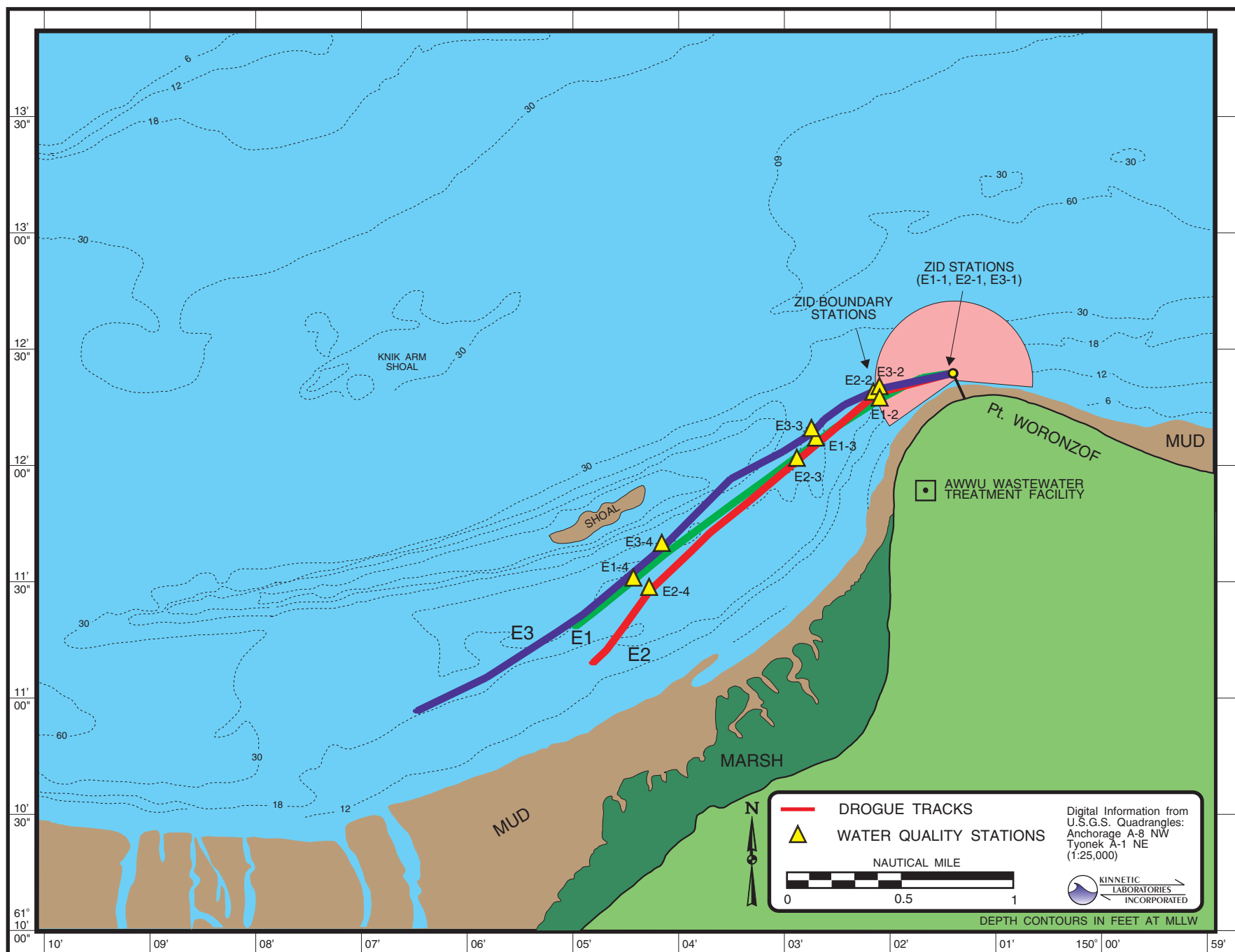


Figure 6. Summary of Ebb Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 23 June 2004.

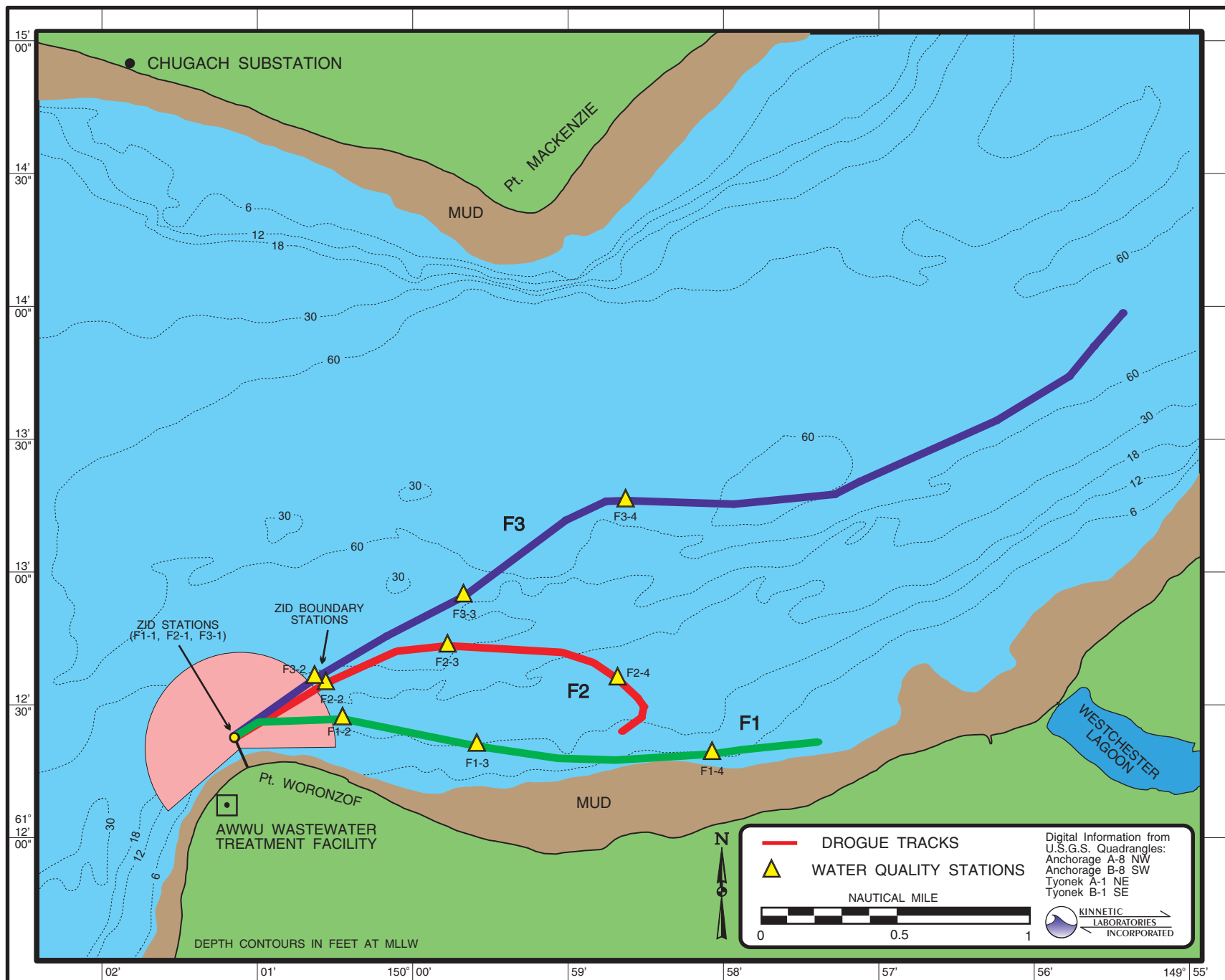


Figure 7. Summary of Flood Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 23 June 2004.

mile before it was recovered at 21:29 ADT. This drogue had an average speed of 59 cm/s. The third flood drogue (F3) was deployed at 21:46 ADT, about 3½ hours after low slack water, and tracked for about 2 hours until recovery at 23:28 ADT. The third drogue traveled in a northeast direction further out from the shoreline, with an average speed of 102 cm/s. The third drogue was tracked for approximately 4 nautical miles to the northeast and was recovered offshore and to the west of the Port of Anchorage.

## **Control Site**

The Point MacKenzie control drogues were deployed and tracked on 24 June 2004. The predicted tidal range during the flood tide was 24.3 ft. Tidal information is provided in Figure 8 and Table 16 (Micronautics, Inc. Tide 1: Rise and Fall®, 2004). A composite of the three drogue trajectories is presented in Figure 9.

All three control drogues had similar tracks with the first drogue (C1) tracking closer to shore. The first drogue was released at 18:45 ADT, 11 minutes before slack water, and traveled to the northeast. After traveling almost 3 nautical miles, the drogue looped in towards shore and became grounded on the west side of Knik Arm across from Cairn Point. This drogue had an average speed of 102 cm/sec over the entire track. The second drogue (C2) was released at 20:54 ADT, about 2 hours into the flood tidal cycle, and tracked until recovery at 21:54 ADT. This drogue had an average speed of 212 cm/s over the entire track and moved towards the northeast offshore of the first drogue and then northerly after passing Cairn Point. The third control drogue (C3) was released at 22:18 ADT, about 3½ hours after high slack water. The drogue traveled in a manner similar to the second drogue, moving northeast into the central channel with an average speed of 364 cm/s. Abreast of Cairn Point, the drogue turned more toward the north for the last half mile of its trajectory.

## **Summary of Water Quality Data**

The summer water quality sampling for all analysis types was conducted concurrently with the drogue tracking studies on 23 - 24 June 2004. As discussed previously, three drogues were released at the control site for the flood tide and three were released at the ZID for both ebb and flood tides. Water samples and CTD measurements were to be obtained at four stations along each drogue's track prior to its grounding. In the current NPDES permit, the ZID boundary is located 650 m distance from the outfall diffuser. To accomplish the ZID site sampling, the vessel was positioned directly upcurrent from the diffuser and allowed to drift down across it. Upon reaching the outfall diffuser, the drogue was dropped and the within-ZID station sampled. The distance from the outfall diffuser was monitored with the DGPS, and upon reaching 650 m distance from the diffuser, the ZID-boundary station was sampled. The third and fourth stations were then sampled along the drogue's path. Due to high current speeds, anchoring the vessel and sampling at each station was not practical or desirable for this type of sampling.

Table 17 provides a summary of the water quality measurements obtained, where the station designation is represented by: drogue drop location (C=control, E=ebb, and F=flood), the first number represents the drogue number, and the second number represents the station along the drogue's path. The final character represents surface (S), mid-depth (M), or bottom (B) sample. Values for pH ranged from 7.70 to 8.09 with no vertical stratification. Turbidity values for water samples collected during the monitoring ranged from a low of 66 Nephelometric Turbidity Units (NTU) to a high of 590 NTU.

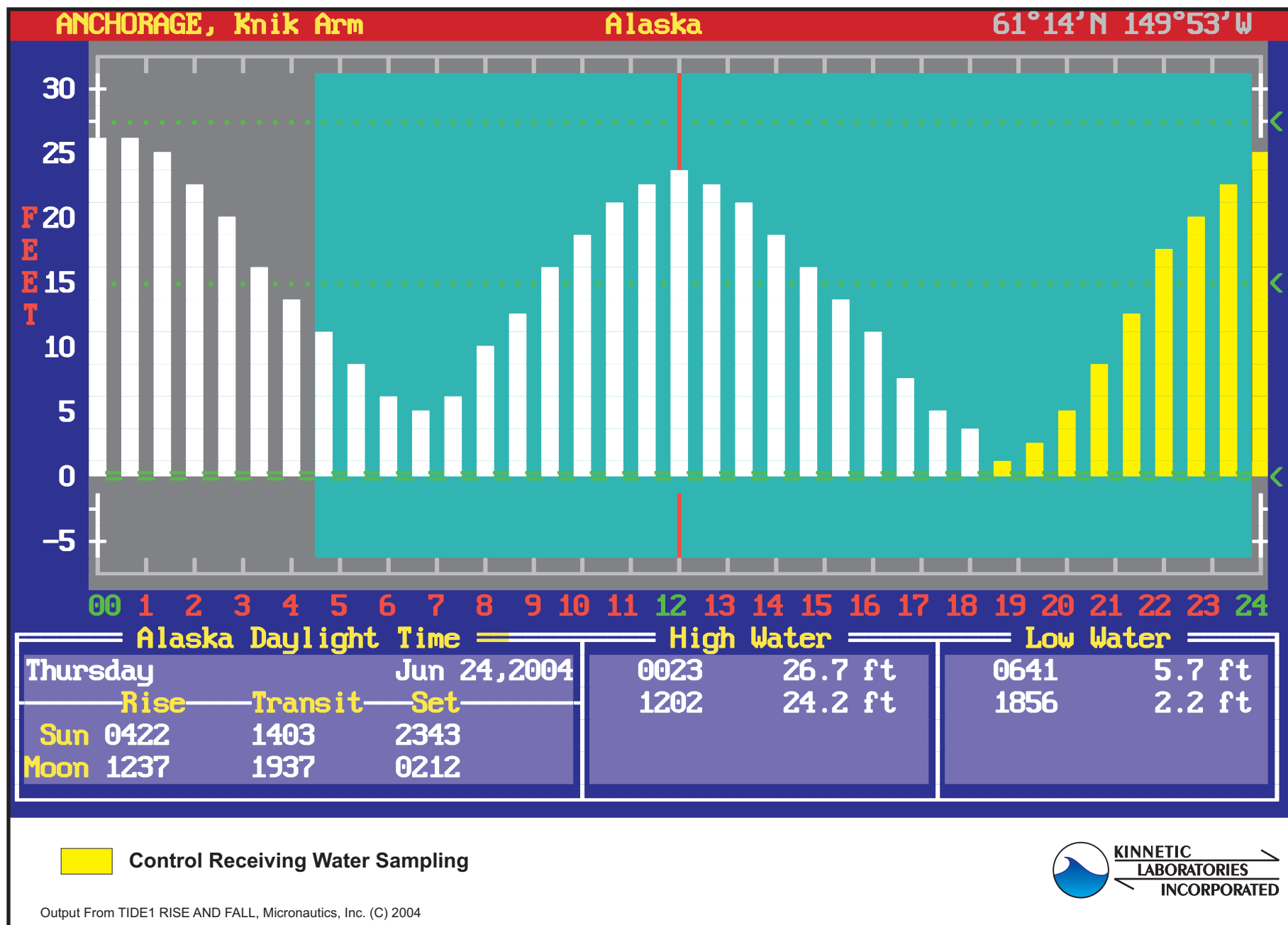


Figure 8. Tidal Information for Receiving Water Sampling, Control Tide.



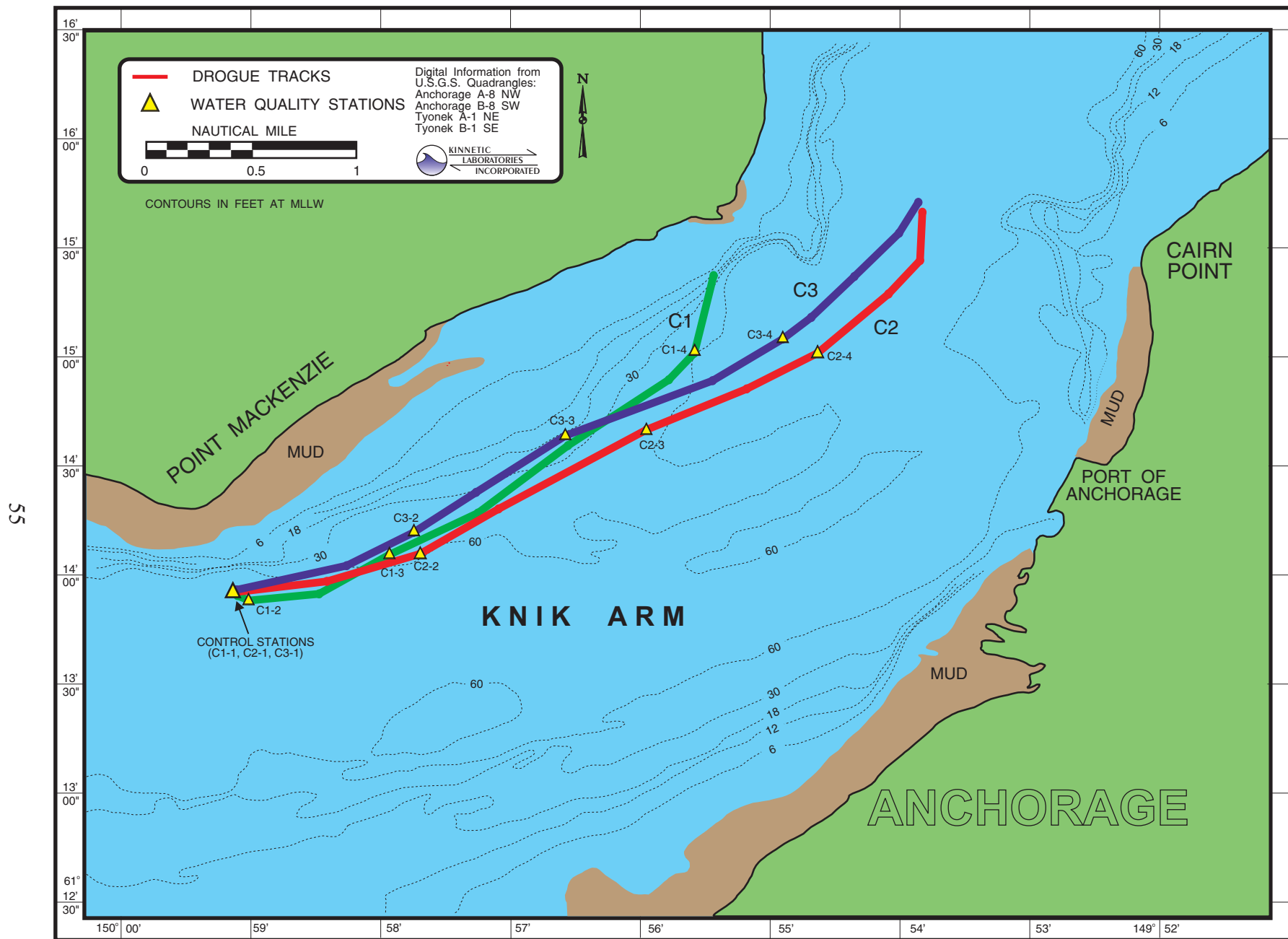


Figure 9. Summary of Control Drogue Tracks and Receiving Water Sampling Locations at Point MacKenzie, 24 June 2004.

**Table 17. Hydrographic and Water Quality Data, 23 and 24 June 2004.**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
<b>JUNE 23</b>												
E1-1S	1135	61° 12.345'	150° 01.275'	0.5	14.22	8.80	NA	11.90	210	20	<0.005	<2.0
-1M				4.5	14.05	9.02	NA	12.17	500			
-1B				9.5	13.96	9.12	NA	12.50	420			
E1-2S	1154	61° 12.236'	150° 01.961'	0.5	14.25	8.81	7.71	11.94	130	10	<0.005	2.0
-2M				5.5	13.96	8.90	7.76	12.78	390			
-2B				11.0	13.81	8.92	7.78	13.45	460			
E1-3S	1209	61° 12.053'	150° 02.562'	0.5	14.09	8.93	7.70	12.31	110	10	<0.005	<2.0
-3M				4.5	14.03	8.90	7.83	13.27	260			
-3B				8.5	13.80	8.92	7.84	13.47	210			
E1-4S	1241	61° 11.457'	150° 04.320'	0.5	14.27	9.18	7.77	12.53	120	25	<0.005	<2.0
-4M				5.0	13.86	9.20	7.81	13.53	280			
-4B				9.5	13.82	9.29	7.82	13.59	560			
E2-1S	1312	61° 12.345'	150° 01.289'	0.5	14.19	9.57	7.78	11.64	150	15	<0.005	<2.0
-1M				4.5	14.10	9.62	7.80	11.83	420			
-1B				9.0	14.08	9.69	7.81	11.89	500			
E2-2S	1318	61° 12.259'	150° 02.011'	0.5	14.13	9.29	7.80	11.79	450	20	0.01	<2.0
-2M				5.0	14.08	9.31	7.81	11.95	460			
-2B				9.5	14.07	9.36	7.82	11.99	420			
E2-3S	1328	61° 11.968'	150° 02.772'	0.5	14.11	8.85	7.81	11.96	400	10	<0.005	<2.0
-3M				2.5	14.09	9.04	7.81	11.97	460			
-3B				4.0	14.10	8.97	7.81	11.97	440			

**Table 17. Hydrographic and Water Quality Data, 23 and 24 June 2004. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
E2-4S	1400	61° 11.415'	150° 04.163'	0.5	14.14	9.29	7.82	12.19	400	15	<0.005	<2.0
-4M				2.5	14.12	9.29	7.83	12.32	450			
-4B				4.5	13.97	9.32	7.82	12.94	430			
E3-1S	1450	61° 12.342'	150° 01.283'	0.5	14.31	9.62	7.80	11.25	480	15	<0.005	<2.0
-1M				3.0	14.30	9.68	7.78	11.21	480			
-1B				5.5	14.30	9.73	7.79	11.20	480			
E3-2S	1457	61° 12.276'	150° 01.987'	0.5	14.33	9.33	7.81	11.25	460	10/10	<0.005	<2.0
-2M				5.0	14.30	9.34	7.81	11.27	490			
-2B				9.5	14.29	9.42	7.81	11.28	470			
E3-3S	1511	61° 12.088'	150° 02.619'	0.5	14.31	9.40	7.81	11.30	380	15	<0.005	<2.0
-3M				3.0	14.27	9.43	7.81	11.35	460			
-3B				5.0	14.25	9.46	7.82	11.40	490			
E3-4S	1544	61° 11.598'	150° 04.038'	0.5	14.35	9.62	7.81	11.33	400	15	<0.005	<2.0
-4M				3.0	14.32	9.66	7.82	11.35	500			
-4B				5.5	14.32	9.74	7.82	11.35	500			
F1-1S	1810	61° 12.349'	150° 01.284'	0.5	14.82	9.38	7.81	10.57	430	20	<0.005	17
-1M				1.0	14.76	9.40	7.82	10.63	450			
-1B				1.5	14.75	9.41	7.82	10.62	480			
F1-2S	1838	61° 12.416'	150° 00.581'	0.5	14.76	9.58	7.80	10.37	190	10	<0.005	<2.0
-2M				1.5	14.63	9.64	7.82	10.36	470			
-2B				2.5	14.56	9.66	7.83	10.35	510			
F1-3S	1855	61° 12.314'	149° 59.715'	0.5	14.66	9.46	7.83	10.37	440	10	<0.005	<2.0
-3M				1.5	14.66	9.47	7.83	10.38	440			
-3B				2.0	14.66	9.47	7.84	10.38	480			

**Table 17. Hydrographic and Water Quality Data, 23 and 24 June 2004. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
F1-4S	1927	61° 12.282'	149° 58.195'	0.5	14.83	9.76	7.86	10.37	370	15	<0.005	<2.0
-4M				1.0	14.82	9.77	7.86	10.37	370			
-4B				1.5	14.82	9.78	7.86	10.37	400			
F2-1S	2006	61° 12.341'	150° 01.293'	0.5	15.03	9.39	7.82	11.95	470	20	<0.005	2.0
-1M				3.5	14.99	9.40	7.83	11.81	490			
-1B				7.0	14.95	9.63	7.82	11.78	500			
F2-2S	2014	61° 12.551'	150° 00.697'	0.5	15.03	9.51	7.83	11.88	460	20	<0.005	<2.0
-2M				5.5	14.92	9.40	7.82	11.76	480			
-2B				10.0	14.88	9.60	7.83	11.72	470			
F2-3S	2027	61° 12.694'	149° 59.908'	0.5	14.76	9.36	7.82	11.46	410	15	<0.005	2.0
-3M				5.5	14.60	9.43	7.83	11.26	540			
-3B				10.0	14.55	9.47	7.84	11.17	560			
F2-4S	2055	61° 12.567'	149° 58.804'	0.5	14.75	9.66	7.83	11.44	240	15	<0.005	<2.0
-4M				4.0	14.60	9.75	7.83	11.24	540			
-4B				7.0	14.58	9.80	7.84	11.19	550			
F3-1S	2146	61° 12.346'	150° 01.295'	0.5	14.44	10.08	7.85	11.52	470	15	<0.005	<2.0
-1M				4.5	14.41	9.93	7.81	11.47	500			
-1B				8.5	14.41	9.96	7.83	11.56	460			
F3-2S	2154	61° 12.575'	150° 01.743'	0.5	14.44	9.71	7.85	11.50	470	10/10	<0.005	<2.0
-2M				7.5	14.34	9.55	7.83	11.85	470			
-2B				15.0	14.30	9.59	7.83	12.05	460			
F3-3S	2206	61° 12.880'	149° 59.799'	0.5	14.48	9.45	7.83	10.75	430	10	<0.005	<2.0
-3M				10.0	14.22	9.41	7.81	12.24	480			
-3B				20.0	14.16	9.47	7.76	12.28	480			

Table 17. Hydrographic and Water Quality Data, 23 and 24 June 2004. (continued)

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
F3-4S	2225	61° 13.244'	149° 58.748'	0.5	14.32	9.38	7.88	11.58	380	15	<0.005	<2.0
-4M				19.5	14.10	9.35	7.87	12.62	460			
-4B				39.0	14.07	9.37	7.89	12.73	490			
JUNE 24												
C1-1S	1845	61° 13.950'	149° 59.105'	0.5	14.86	9.68	7.98	9.03	82	10	<0.005	<2.0
-1M				11.5	14.41	9.65	7.98	9.63	580			
-1B				23.0	14.35	9.63	7.97	10.30	580			
C1-2S	1901	61° 13.904'	149° 58.987'	0.5	15.07	10.17	8.00	9.09	66	10	<0.005	2.0
-2M				11.5	14.41	9.98	7.98	9.37	570			
-2B				22.5	14.33	9.76	7.97	10.45	590			
C1-3S	1932	61° 14.116'	149° 57.904'	0.5	15.06	9.85	8.01	8.21	180	10	<0.005	<2.0
-3M				7.0	14.50	9.81	7.98	9.53	140			
-3B				14.0	14.38	9.83	7.98	10.01	470			
C1-4S	2007	61° 15.040'	149° 55.550'	0.5	14.21	10.29	8.09	6.05	330	10	<0.005	<2.0
-4M				11.0	14.78	10.02	8.03	7.51	420			
-4B				22.0	14.43	9.92	7.97	9.58	470			
C2-1S	2054	61° 13.946'	149° 59.096'	0.5	14.74	9.81	7.97	10.00	320	15	<0.005	4.0
-1M				10.0	14.71	9.87	7.97	10.05	380			
-1B				20.5	14.71	10.00	7.98	10.10	370			
C2-2S(A)	2104	61° 14.121'	149° 57.667'	0.5	14.68	9.72	7.97	10.13	280	10	<0.005	2.0
-2S(B)	2104			0.5	14.65	9.25	7.97	10.23	260	10/10	<0.005	<2.0
-2S(C)	2104			0.5	14.63	9.28	7.97	10.26	310	10	<0.005	<2.0
-2M				7.0	14.55	9.47	7.97	10.23	410			

**Table 17. Hydrographic and Water Quality Data, 23 and 24 June 2004. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
-2B				14.0	14.46	9.50	7.98	9.92	420			
C2-3S	2122	61° 14.687'	149° 55.916'	0.5	14.74	9.72	7.99	9.84	280	10	<0.005	<2.0
-3M				9.5	14.51	9.75	7.98	10.40	500			
-3B				18.5	14.49	9.83	7.98	9.99	550			
C2-4S	2135	61° 15.038'	149° 54.597'	0.5	14.65	9.61	7.98	10.01	250	10	<0.005	2.0
-4M				16.0	14.48	9.64	7.98	9.96	580			
-4B				32.0	14.47	9.68	7.99	9.87	490			
C3-1S(A)	2218	61° 13.956'	149° 59.084'	0.5	14.80	9.74	7.96	11.37	480	15	<0.005	<2.0
-1S(B)	2218			---	---	---	---	---	510	10	---	<2.0
-1S(C)	2218			---	---	---	---	---	490	10	---	<2.0
-1M				11.5	14.44	9.81	7.95	11.63	520			
-1B				23.0	14.34	9.99	7.95	11.54	580			
C3-2S	2230	61° 14.219'	149° 57.715'	0.5	14.71	9.85	7.97	11.32	480	15	<0.005	2.0
-2M				5.5	14.74	9.88	7.97	11.34	460			
-2B				11.0	14.48	10.03	7.97	11.53	530			
C3-3S	2243	61° 14.662'	149° 56.546'	0.5	14.73	9.66	7.97	11.15	420	10	<0.005	<2.0
-3M				7.0	14.62	9.72	7.97	11.31	430			
-3B				14.0	14.51	9.84	7.97	11.48	540			
C3-4S	2300	61° 15.106'	149° 54.864'	0.5	14.70	9.61	7.99	11.07	410	5/5	<0.005	<2.0
-4M				19.0	14.51	9.62	7.98	11.44	520			
-4B				38.5	14.45	9.75	7.99	11.43	420			

<sup>a</sup> Fecal coliform reported as MPN/100 mL.

<sup>b</sup> Values from CTD for 0.5 m depth taken as close to surface as possible.

NA Not available; CTD malfunction.

--- Samples not collected.

The waters of the inlet are extremely well-mixed both vertically and horizontally, as indicated by the CTD data. During the survey, temperatures ranged from a minimum of 13.80°C to a maximum of 15.07°C. Salinities were found to vary from a minimum of 8.80 parts per thousand (ppt) to a maximum of 10.29 ppt. Salinities were generally found to increase slightly during the flood and decrease on the ebb, as is typical for estuaries. The control stations across the inlet were very similar this year in terms of both temperature and salinity to the ebb and flood stations. Oftentimes in the past, the control stations are found to be slightly warmer and less saline due to a greater influence from river runoff. Values for DO collected in-situ by the CTD ranged from 6.05 to 13.59 mg/L with most concentrations being at saturation.

Representative hydrographic profiles of water quality are presented for a ZID boundary station during flood tide, Station F2-2, and a typical station from the third control drogue drop, Station C3-2 (Figure 10). The water column was found to be well-mixed from the surface to the bottom at all stations. Refer to Appendix D8 for hydrographic profiles from each water quality station.

Surface samples were obtained at each station for the analysis of color, TRC, and fecal coliform bacteria. Color values ranged from 5 to 25 color units on the platinum-cobalt scale. Color ranged from 5 to 15 at the control stations and from 10 to 25 at the outfall stations with six samples exceeding the AWQS of 15 color units. This included three within-ZID stations (E1-1, F1-1, and F2-1) at 20 units, two ZID boundary stations (E2-2 and F2-2) at 20 units, and one nearfield station (E1-4) at 25 units. The cause of these high color values was not apparent as color has not been a problem during past years. Except for one value, all TRC concentrations were below the PQL of 0.005 mg/L. TRC was detected at 0.01 mg/L at Station E2-2, which is a ZID boundary station. It should be noted that the MDL achievable for TRC analysis is higher than the State-specified limit of 0.002 mg/L (for salmonid fish). The amperometric method that was used is the preferred method since it is affected little by common oxidizing agents, temperature, turbidity, or color, but all TRC methods are subject to positive interferences in estuarine or marine waters. The average TRC concentrations of the effluent (collected every three hours for a total of eight samples per 24-hr period) as reported in the Monthly Monitoring Report for the sampling dates 23 and 24 June 2004 were 0.21 and 0.04 mg/L, respectively.

Fecal coliform values this year were quite low and ranged from <2 to 17 FC MPN/100 mL. The highest fecal coliform concentration was seen at the within-ZID Station F1-1, taken just after low slack water. The next highest concentrations seen at the outfall stations were at F2-1, F2-3, and E1-2 with a concentration of 2 FC MPN/100 mL. The overall median for fecal coliform samples at all outfall stations (both ebb and flood) was <2 FC MPN/100 mL. Almost all control station fecal concentrations were <2 FC MPN/100 mL, the exception being the 4 FC MPN/100 mL seen at Station C2-1. See Sections 3.2.2 and 5.2.2 below for more discussion of fecal coliform.

In addition to routine monitoring conducted at each water quality station, supplemental surface samples were collected from the first three stations along the first drogue trajectory for the ZID and control floods. A sample of final effluent was also obtained at the same time for comparison. Supplemental samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), dissolved and total recoverable trace metals, cyanide, and TSS.

Metals, cyanide, and TSS results for these samples are presented in Table 18. Dissolved metals concentrations were found to be low, but were quite variable between stations. For all dissolved metals except chromium, the highest concentrations were seen at Station F1-1 located at low slack water above the diffuser, within the ZID. Since dissolved chromium was found to

## Outfall Station

## Control Station

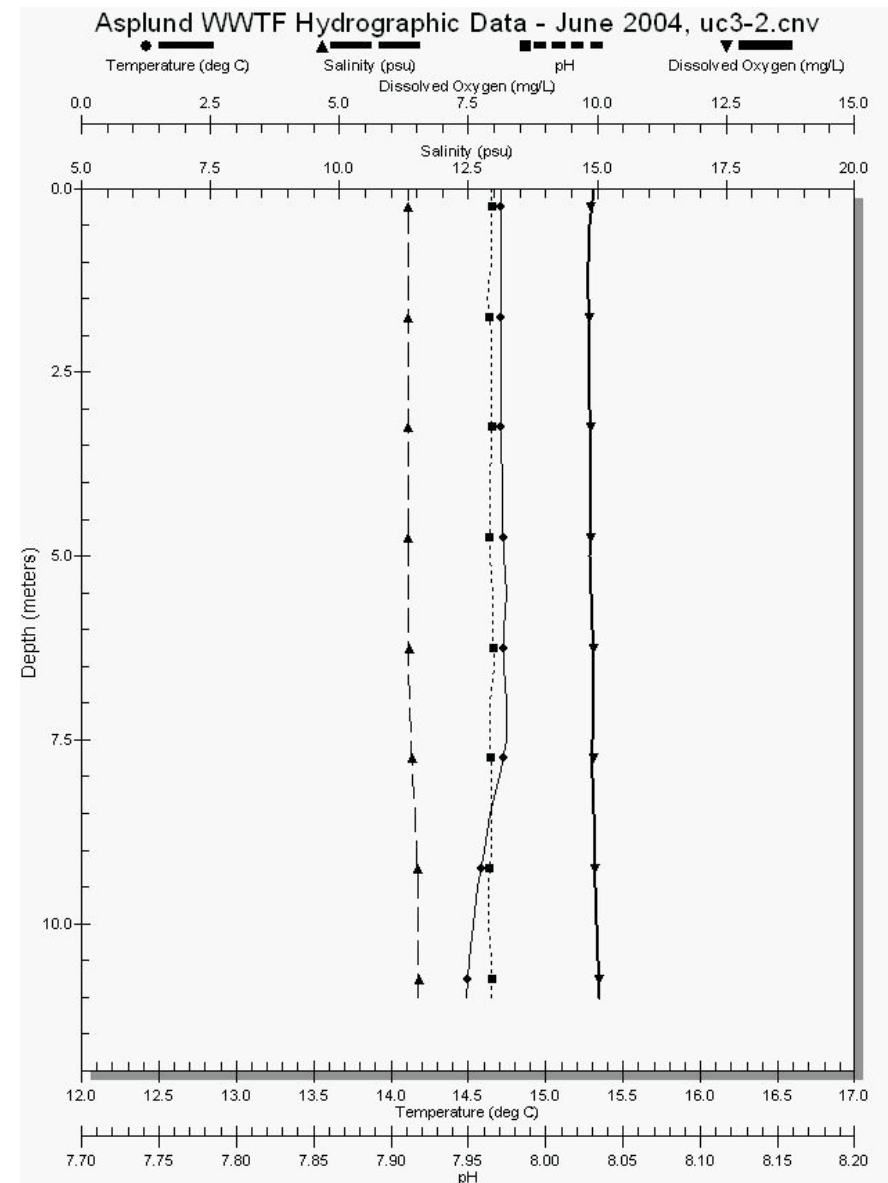
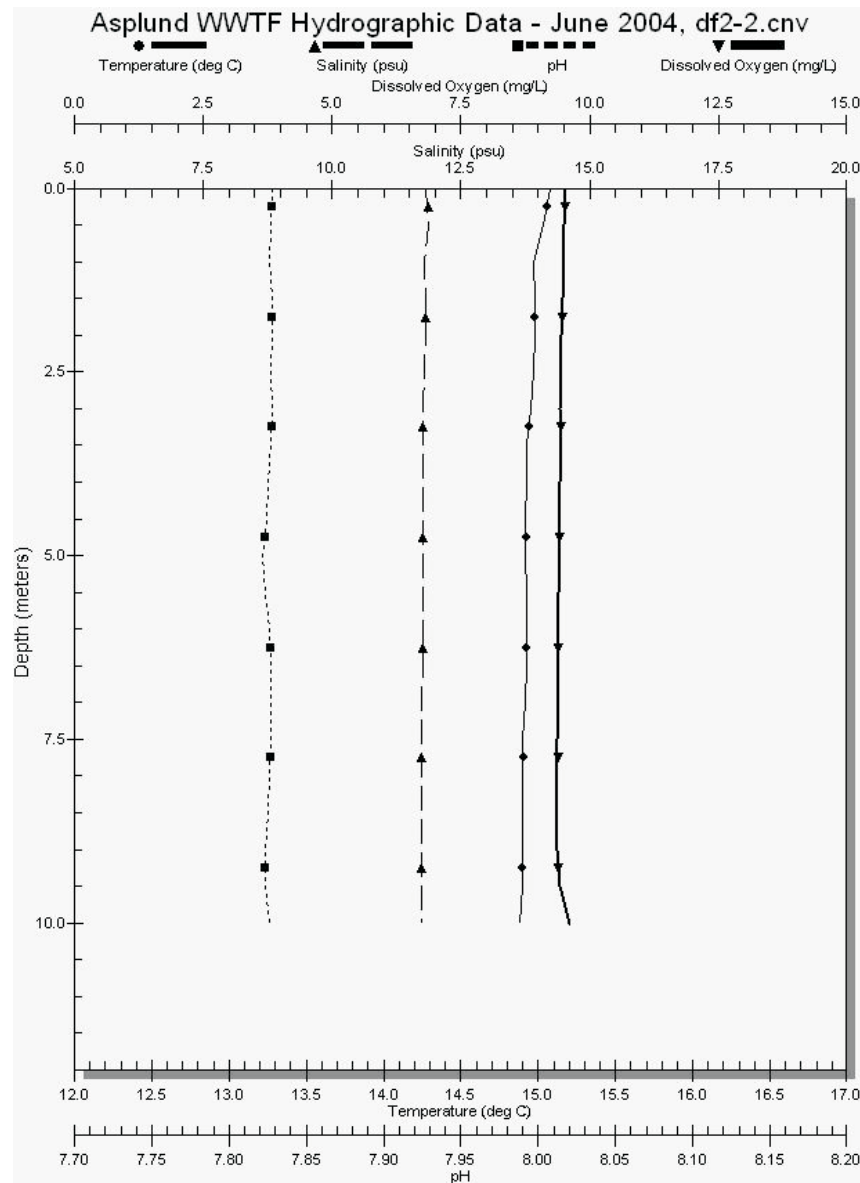


Figure 10. Sample Hydrographic Profiles from Outfall and Control Stations, June 2004.



**Table 18. Concentrations of Dissolved Metals, Total Recoverable Metals, Cyanide, and Total Suspended Solids in Receiving Water and Effluent Samples.** Values have not been blank corrected.

Station	Arsenic	Cadmium	Cyanide	Chromium	Copper	Mercury	Nickel	Lead	Silver	Zinc	TSS
	µg/L					ng/L	µg/L				mg/L
Dissolved Metals											
F1-1S (WITHIN ZID)	1.90	0.0836	NA	0.293	5.60	0.792	1.29	0.250	0.020 U	3.15	NA
F1-2S (ZID BOUNDARY) <sup>a</sup>	1.66/1.70	0.0663/ 0.0614	NA	0.293/0.290	1.96/1.90	0.536/ NA	1.09/1.07	0.0549B/ 0.0549B	0.020 U/ 0.020 U	1.17/1.09	NA
F1-3S (NEAR FIELD)	1.54	0.0559	NA	0.292	1.09	0.633	1.14	0.0228B	0.020 U	0.953	NA
C1-1S (CONTROL)	1.37	0.0535	NA	0.293	0.967	0.768	0.981	0.0242B	0.020 U	0.553	NA
C1-2S (CONTROL)	1.35	0.0544	NA	0.311	1.14	0.520	1.01	0.0237B	0.020 U	1.20	NA
C1-3S (CONTROL)	1.33	0.0467	NA	0.270	0.922	0.550	0.938	0.0221B	0.020 U	0.756	NA
EFFLUENT	1.39	0.106	NA	0.0855	27.0	6.40	0.499	2.23	0.252	42.9	NA
DETECTION LIMIT	0.016	0.014	NA	0.036	0.027	0.12	0.053	0.014	0.020	0.136	NA
Total Metals											
F1-1S (WITHIN ZID)	15.6	0.191	ND	27.0	40.6	67.7	26.7	8.29	0.564	73.6	590
F1-2S (ZID BOUNDARY)	5.45	0.0856	ND	8.73	11.8	15.5/15.6 <sup>a</sup>	8.82	2.30	0.0699	22.4	570
F1-3S (NEAR FIELD)	15.7	0.160	ND	27.8	45.3	50.4	27.6	8.33	0.0697	70.2	630
C1-1S (CONTROL)	3.48	0.0686	ND	5.02	6.64	8.09	5.38	1.23	0.020 U	11.9	72
C1-2S (CONTROL) <sup>b</sup>	3.40	0.0660	ND/ND	4.68	6.58	7.83	5.26	1.18	0.020 U	12.2	78/80
C1-3S (CONTROL)	5.82	0.0828	ND	9.55	12.6	16.0	9.92	2.58	0.0261	23.5	170
EFFLUENT	1.88	0.470	1.4	5.63	70.9	97.4	0.571	7.48	3.59	120	76
DETECTION LIMIT	0.016	0.014	1.0 <sup>c</sup>	0.036	0.027	0.12	0.053	0.014	0.020	0.136	5.0 <sup>c</sup>

<sup>a</sup> Field sample value/lab duplicate value (where applicable)

<sup>b</sup> Field sample value/field duplicate value (where applicable)

<sup>c</sup> Reporting limit

B Blank contamination may have affected sample concentration

NA Not applicable

ND None detected

U Not detected at or above detection limit.

be lower in the effluent versus the receiving water, this result may have been due to the effluent diluting the receiving water within the ZID boundary. The maximum dissolved chromium concentration was seen at control Station C1-2. Dissolved mercury was nearly as high in concentration at the control Station C1-1 (0.768 ng/L) as that at the within-ZID, Station F1-1 (0.792 ng/L). All dissolved metals concentrations met water quality criteria as they were considerably less than the State of Alaska SSWQC for the Point Woronzof area. Dissolved copper was reported at 5.60 µg/L at Station F1-1, which was in excess of the SSWQC of 3.1 µg/L, but this criterion does not apply to this station as it was located within the ZID and at the outfall diffuser boil. Dissolved copper values at the ZID-boundary (Station F1-2) and the near-field station (F1-3) met the SSWQC. Cyanide results from the ambient water stations were all below the reporting limit of 1 µg/L. The AWQS for this parameter is 1 µg/L. The cyanide concentration in the effluent sample collected in conjunction with the receiving water sampling was 1.4 µg/L.

Total metals concentrations were quite variable, and with the exception of silver, differences between the outfall and control sites did not appear to exist that could be attributed to the discharge but were the result of differences in TSS concentrations. Station F1-1 was found to have the highest concentrations for cadmium, mercury, silver, and zinc tested by total recoverable methodology. These relatively high concentrations can be attributed to high suspended sediment load at this station as evidenced by the 590 mg/L of TSS. Total arsenic, chromium, copper, nickel, and lead were highest at Station F1-3. Station F1-3 had the highest TSS value of 630 mg/L. For the control stations, Stations C1-3 had higher concentrations for all the total recoverable metals tested than Stations C1-1 or C1-2. These relatively high concentrations can be attributed to a higher suspended sediment load at this station as evidenced by the 170 mg/L of TSS seen here, twice that seen at the other two control stations. Total suspended solid results ranged from 72 to 170 mg/L at the control stations compared to 570 to 630 mg/L at the outfall stations. The effluent sample had a TSS concentration of 76 mg/L.

Hydrocarbon analyses results are presented in Table 19. Total aromatic hydrocarbons (TAH) as BETX (EPA Method 602 samples from the concurrent summer dry sampling) was determined by summing benzene, ethylbenzene, toluene, and total xylenes. For values reported as ND, the reporting limit was used in the summation. Total aromatic hydrocarbons at the water quality stations ranged from ND to 3.18 µg/L with detectable quantities at only three stations. Detectable concentrations were seen at Stations F1-1, F1-2, and C1-1 with concentrations of 3.18, 1.84, and 1.99 µg/L, respectively. Concentrations were all well below the receiving water quality standard of 10 µg/L. The effluent sample had a TAH concentration of 8.31 µg/L, significantly less than the MAEC of 1,810 µg/L.

All concentrations of individual PAHs were summed and reported as total PAHs (TPAH) in Table 19. The TPAH values ranged from 0.064 to 0.439 µg/L at the control stations and from 0.100 to 0.310 µg/L at the outfall stations. The highest TPAH was seen at Station C1-2. The TPAH concentration in the effluent sample was 4.50 µg/L.

Total aqueous hydrocarbons (TAqH) as determined by PAHs plus BETX were calculated for the six stations and effluent, with the contribution from BETX assumed to be 2 µg/L (the sum of the individual detection limits for each ND compound; Table 19). Concentrations of TAqH were

**Table 19. Supplemental Receiving Water and Effluent Hydrocarbon Analyses.**

PARAMETER	CONTROL FLOOD SAMPLES			ZID FLOOD SAMPLES			Effluent
	C1-1S	C1-2S	C1-3S	F1-1S	F1-2S <sup>a</sup>	F1-3S	
Volatile Organics (EPA 602) in µg/L with reporting limit in parenthesis if ND							
Benzene	0.45 J	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)/ND(0.5)	ND(0.5)	0.24 J
Toluene	0.54	ND(0.5)	ND(0.5)	1.3	0.34 J / 0.31 J	ND(0.5)	6.4
Ethylbenzene	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)/ND(0.5)	ND(0.5)	0.37 J,COL
Xylenes (Total)	ND(0.5)	ND(0.5)	ND(0.5)	0.88 J	ND(0.5)/ND(0.5)	ND(0.5)	1.3 COL
Total Aromatics (as BETX)	1.99	ND	ND	3.18	1.84 / 1.81	ND	8.31
Polynuclear Aromatic Hydrocarbons (PAH) by GC/MS in µg/L							
TPAH without perylene	0.125	0.439	0.064	0.255	0.310	0.100	4.501
Total Aqueous Hydrocarbons (TAqH) in µg/L							
TAqH <sup>b</sup>	2.12	2.44	2.06	3.44	2.15 / 2.12	2.10	12.81

<sup>a</sup> Duplicate field sample analysis provided (value/duplicate value)

<sup>b</sup> Defined by the State of Alaska as BETX analyte values from EPA Method 602 plus PAH analyte values from EPA Method 610 analysis; these calculated values include the full suite of PAH analyte values from GERG SOP 8901/9733 not analyte values from EPA method 610

COL More than 40% RPD between primary and confirmation column results. The lower of the two results is reported

ND None detected

J Below MDL or MRL (estimated value)

below the receiving water standard of 15 µg/L at all control stations and all outfall stations. Control stations ranged in TAqH from 2.06 to 2.44 µg/L, while outfall station TAqH concentrations ranged from 2.10 to 3.44 µg/L. The concentration of TAqH in the effluent was estimated at 12.81 µg/L, compared to the MAEC of 2,715 µg/L.

### 3.2.2 Intertidal Zone and Stream Bacterial Sampling

Intertidal zone and stream bacteriological sampling was performed on 23 June 2004 (Table 20). Refer to Figure 3 for a map of the station locations. Intertidal zone sampling began approximately 1 hour prior to high tide at 22:50 ADT and was completed at 23:50 ADT. Two

**Table 20. Summary of Bacterial Analyses, 23 June 2004.**

<b>Station and Replicate</b>	<b>Sample Time (ADT)</b>	<b>Fecal Coliform MPN/100 mL</b>
IT-1 Replicate 1	23:50	<2.0
IT-1 Replicate 2	23:50	2.0
IT-2 Replicate 1	23:45	4.0
IT-2 Replicate 2	23:45	<2.0
IT-3 Replicate 1	23:41	7.0
IT-3 Replicate 2	23:41	2.0
IT-4 Replicate 1	23:37	2.0
IT-4 Replicate 2	23:37	2.0
IT-5 Replicate 1	23:32	<2.0
IT-5 Replicate 2	23:32	<2.0
IT-6 Replicate 1	23:27	<2.0
IT-6 Replicate 2	23:27	4.0
IT-7 Replicate 1	23:20	<2.0
IT-7 Replicate 2	23:20	2.0
IT-C Replicate 1	22:50	4.0
IT-C Replicate 2	22:50	2.0
Plant Effluent Rep. 1	17:37	2.0
Plant Effluent Rep. 2	17:37	<2.0
Fish Creek Rep. 1	20:34	<2.0
Fish Creek Rep. 2	20:34	2.0
Chester Creek Rep.1	20:50	2.0
Chester Creek Rep.2	20:50	<2.0
Ship Creek Rep. 1	20:08	2.0
Ship Creek Rep. 2	20:08	2.0

replicates were taken at all intertidal stations. Stream sampling was conducted from 20:08 to 20:50 ADT on 23 June 2004. In addition, an effluent sample was collected at the plant at 17:37 ADT on this date.

Fecal coliform concentrations in the intertidal were very low this year and ranged from <2.0 to 7 FC MPN/100 mL. The highest fecal concentrations were seen at the first replicate at Station IT-3 (7 FC MPN/100 mL), the first replicate at Station IT-2 (4 FC MPN/100 mL), and the second replicate at Station IT-6 (4 FC MPN/100mL). The control station IT-C, located across the Inlet near Point MacKenzie, had concentrations of 2 and 4 FC MPN/100 mL for the two replicates. Fecal coliform concentrations found in Fish, Chester, and Ship Creeks were extremely low compared to those seen in past years, with all values at or below 2.0 FC MPN/100 mL. The replicate plant effluent samples taken on the same day showed fecal concentrations of 2 and <2 FC MPN/100 mL.

### **3.3 SEDIMENT AND BIOACCUMULATION MONITORING**

A sediment quality and bioaccumulation program was to be conducted in the summer during the fourth year after the effective date of the permit. The sediment quality program included sampling at three intertidal and two subtidal locations during 2003, and these sediment sampling results were included in the 2003 report. The bioaccumulation component of the program, however, could not be performed during either 2003 or 2004 due to insufficient intertidal algae growth. The bioaccumulation program was to include sampling of the yellow-green algae *Vaucheria* spp. from two intertidal locations. However, due to insufficient algae growth during both of the summers of 2003 and 2004, the permit-specified bioaccumulation program could not be performed. This algae is normally associated with brackish water and often is present near high tide level near river mouths or in areas of seepage and runoff of freshwater (Kozloff, 1993). Since the summers of 2003 and 2004 were relatively dry with low runoff, it is speculated that the Upper Cook Inlet in the vicinity of Anchorage was higher in salinity than normal which inhibited the normal growth of this algae. The mud-flats near the outfall were observed throughout both summers, and the extensive mats of *Vaucheria* spp. that normally grow each summer were never present during either 2003 or 2004. In consultation with AWWU and discussions with EPA, it was proposed to collect Pacific cod (*Gadus macrocephalus*) from the shallow subtidal/intertidal area at the two locations to fulfill the permit requirements to conduct a bioaccumulation program. Results of that sampling are presented in this section.

#### **3.3.1 Bioaccumulation Monitoring**

Four replicate Pacific cod bioaccumulation samples were collected for chemistry analyses from the intertidal area approximately 1200 m east of Point Woronzof on 14 October 2004 (Station IT-2), and three replicates were collected at Station IT-C on 19 October 2004 across Knik Arm near the control station located in the vicinity of Point MacKenzie. Numerous beach seine hauls were required to collect the required fish. Due to the relatively small size (75-250 mm) of the fish caught, and the quantity of tissue needed by each laboratory, each replicate consisted of a number of individual fish that were homogenized and processed for full body burden analysis of pollutants. Bioaccumulation samples were analyzed for metals, cyanide, semi-volatiles and PAHs, pesticides, and PCBs (Table 21).

**Table 21. Bioaccumulation Data, 14 and 19 October 2004.**

Pollutant	Outfall (IT-2) Rep. 1	Outfall (IT-2) Rep. 2	Outfall (IT-2) Rep. 3	Outfall (IT-2) Rep. 4	Control (IT-C) Rep. 1	Control (IT-C) Rep. 2	Control (IT-C) Rep. 3
<b>METALS (EPA 6020 &amp; EPA 7471B [Hg only]) AND CYANIDE (EPA 335.2) mg/kg (wet weight)</b>							
Antimony	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
Arsenic	7.74	3.79	2.34	2.60	4.21	3.99	3.05
Beryllium	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
Cadmium	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
Chromium	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
Copper	1.08	1.55	1.67	1.44	1.40	1.06	1.25
Cyanide	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)
Lead	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
Mercury	0.054	0.083	ND (0.02)	ND (0.02)	0.031	0.024	ND (0.02)
Nickel	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
Selenium	ND (1.00)	1.35	ND (1.00)	1.25	ND (1.00)	ND (1.00)	1.11
Silver	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
Thallium	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
Zinc	11.2	13.0	11.5	9.91	9.59	13.3	11.9
<b>EPA 8082 PCBs - No Substances Detected</b>							
<b>EPA 8270C/SIM SEMI-VOLATILES &amp; PAHs (625 LIST) ug/kg (wet weight)</b>							
2,4,6-Trichlorophenol	680 J,D	680 J,D	670 J,D	670 J,D	670 J,D	660 J,D	660 J,D
Pentachlorophenol	1,000 J,D	980 J,D	920 J,D	860 J,D	830 J,D	820 J,D	810 J,D
Butyl Benzyl Phthlate	ND (2,000)	ND (2,000)	2,100 D	ND (2,000)	ND (2,000)	ND (2,000)	ND (2,000)
<b>EPA 8081A O-C PESTICIDES (NOAA LIST) ug/kg (wet weight)</b>							
Hexachlorobenzene	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	0.88 J,P
Beta-BHC	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.2)	ND (1.0)	ND (1.0)	0.42 J,P
Gamma-BHC (Lindane)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	0.50 J,P
Endosulfan I	ND (1.0)	ND (1.0)	ND (1.0)	0.44 J	ND (1.0)	ND (1.0)	ND (1.4)
Alpha- Chlordane	0.63 J	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.4)
Dieldrin	0.90 J	0.37 J	ND (1.0)	ND (1.0)	0.45 J,P	ND (1.0)	ND (1.4)
2,4'-DDE	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	0.11 J,P	ND (1.0)	ND (1.4)
4,4'-DDE	1.4 P	0.93 J	ND (1.0)	ND (1.0)	0.49 J,P	ND (1.0)	ND (1.4)
Endosulfan II	ND (1.0)	0.37 J	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.4)
Methoxychlor	4.8 B	ND (1.0)	ND (1.0)	ND (1.0)	2.2 B	ND (1.0)	ND (1.4)
Chlorpyrifos	ND (1.0)	ND (1.0)	0.45 J,P	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.4)
Trans-Nonachlor	0.83 J,P	0.67 J	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.4)
Cis-Nonachlor	0.49 J,P	ND (1.0)	ND (1.0)	ND (1.0)	0.55 J,P	0.72 J	ND (1.4)
2,4'-DDT	ND (1.0)	0.81 J,P	ND (1.0)	ND (1.0)	0.36 J	ND (1.0)	ND (1.4)

B The analyte was detected in the associated method blank at a level that is significant relative to the sample result.

D The reported result is from a dilution.

J Estimated value below MRL but greater than or equal to the MDL.

ND None detected.

P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.  
Detection limits or reporting limits are included in parentheses for non-detected (ND) values

Most metal concentrations were low and/or below detection limits. Arsenic, copper, and zinc were detected in all replicate samples collected from both the outfall and control locations. Metals concentrations were found to be very similar between the two sites, and no statistically significant differences were found. Mercury and selenium were also detected in some of the replicates from each location. Concentrations of antimony, beryllium, cadmium, chromium, cyanide, lead, nickel, silver, and thallium were below the laboratory detection limits for all samples. Arsenic was detected at variable concentrations near Point Woronzof, ranging from 2.34 to 7.74 mg/kg, copper ranged from 1.08 to 1.67 mg/kg, and zinc ranged from 9.91 to 13.0 mg/kg. Similar concentrations were seen in the tissue from the control site: arsenic ranged from 3.05 to 4.21 mg/kg, copper ranged from 1.06 to 1.40 mg/kg, and zinc ranged from 9.59 to 13.3 mg/kg. Mercury was similar in concentration at the two sites ranging from <0.02 (ND) to 0.083 mg/kg, and was detected in two of four samples from the outfall site and in two of three samples from the control site. Selenium was also similar in concentration at the two sites, ranging from <1.0 (ND) to 1.35 mg/kg, and was detected in two of four samples from the outfall site and in one of three samples from the control site.

There were no PCBs detected in the samples from either the outfall or control locations. Two semi-volatile analytes, 2,4,6-trichlorophenol and pentachlorophenol, were detected at low level concentrations in all samples, but all concentrations were estimated (J) quantities that were below the MRL. One additional semi-volatile analyte (butyl benzyl phthalate) was detected in one of the four samples from the outfall site at a concentration slightly above the MRL. In addition, the laboratory qualified all of the data with a (D) indicating that the samples had to be diluted prior to analysis as result of matrix interference problems. As a result, all semi-volatile data have been appropriately qualified. No statistical analyses were conducted for the semi-volatile compounds since in the majority of cases where an analyte was detected, the quantity was an estimated value that was below the MRL. Based on these analyses, no concentrations of semi-volatile were seen that could be attributed to the outfall.

A total of 14 different pesticides were seen in the tissue analyses from the outfall and control locations at the trace level MRLs utilized for this program. All concentrations were either low-level estimates (qualified with a J) and/or qualified with a P indicating that the confirmation criteria were exceeded. In addition, methoxychlor was qualified with a B indicating that it was also detected in the method blank. All concentrations seen were very low and in the parts per trillion range, with no noticeable difference between the outfall and control samples. Four of the analytes, hexachlorobenzene, beta-BHC, gamma-BHC (lindane), and 2,4'-DDE were seen in only one replicate from the control site. Five other pesticides, endosulfan I & II, alpha-chlordane, chlorpyrifos, and trans-nonachlor, were seen in only one or two (trans-nonachlor) samples from the outfall site. The remaining five pesticides detected (dieldrin, 4,4'-DDE, methoxychlor, cis-nonachlor, and 2,4'-DDT) were found at similar levels in a number of samples from both the outfall and control locations. Previous effluent monitoring has not shown inputs of any pesticides from the Point Woronzof discharge. Given the fact that the pesticides appear to be equally distributed between the outfall and control locations, this would indicate a source other than the discharge. It is possible that the source of these pesticides may be agricultural development in the Matanuska Valley; these compounds may be making their way into Knik Arm through surface runoff. In addition, these low-levels of pesticides seen in the samples may be the result of laboratory contamination, as the levels detected were very low given the trace level MRLs that the laboratory attempted to achieve for the program.





## **4.0 QUALITY ASSURANCE/QUALITY CONTROL**

### **4.1 OBJECTIVES**

The program includes a comprehensive quality assurance/quality control (QA/QC) program that encompasses all aspects of the project, from initial sample collection and field observation recording through laboratory analysis and data analysis to reporting. The objectives of the QA/QC program were to fully document the field and laboratory data collected, to maintain and document data quality, and to ensure that the data collected are of sufficient quality to be comparable with data collected through other EPA-regulated NPDES programs. The program was designed to allow the data to be assessed by the following parameters:

- Precision
- Accuracy
- Comparability
- Representativeness
- Completeness.

These parameters were controlled by adhering to documented methods and procedures, by the analysis of quality control (QC) samples on a routine basis, through the use of laboratories with existing QA/QC plans, through data review and verification procedures, and through a comprehensive sample documentation program. Throughout the program, KLI coordinated with the subcontracting laboratories to ensure that their in-house QA/QC programs were being implemented to meet the required standards.

Quality control activities in the field included adherence to documented procedures, including those in the program workplan, and the comprehensive documentation of sample collection and sample identification information. Sample integrity and identification were ensured by a rigidly-enforced chain of custody program. The chain of custody procedure documents the handling of each sample from the time the sample was collected to the arrival of the sample at the laboratory.

Analytical methods in use on the program have been approved and documented by EPA. These methods were used as project-specific protocols to document and guide analytical procedures. Adherence to these documented procedures ensures that analytical results are properly obtained and reported.

### **4.2 FIELD QUALITY CONTROL**

Quality control activities in the field consisted of the following:

- adherence to documented procedures in the workplan
- cross-checking of field identifications, measurements, and recording to ensure consistency and accuracy
- comprehensive documentation of field observations, sample collection, and sample identification information.

Sampling procedures proposed for this project have been successfully used for a number of years on the Asplund WPCF monitoring program. The use of documented and well-known procedures provides for greater likelihood of obtaining environmental samples uncontaminated by sampling procedures or apparatus. The use of project-specific field forms and data entry sheets also provide guidance for sampling procedures. Adherence to these procedures and use of these project documents helped ensure that data collected over the course of the project were comparable and accurate and that the study results are representative of conditions existing at the sampling sites.

#### **4.2.1 Documentation**

For observations made in the field, cross-checking between personnel were used as the primary method of quality control. These included, for example, review of navigational information recorded on the drogue field log. As described in Section 2.5, sample documentation began in the field using pre-printed log forms, labels, COC forms, and pre-determined sample identification numbers that were designed specifically for use on this project. This extensive field documentation provided a paper trail that exists for each sample or field observation and ensures credibility of the data. All field records were reviewed by the field crew leader as soon as possible after sampling was completed. Completed field logs were filed at the KLI Anchorage office upon return from the survey.

Sample integrity and identification were ensured by the COC program. The chain of custody procedure documented the handling of a sample from the time the sample was collected to the arrival of the sample at the laboratory. At the time of shipment, the field personnel kept a copy of the completed chain of custody form, and the original accompanied the samples to the laboratory.

#### **4.2.2 Sample Handling**

Samples were frozen, chilled, and/or preserved as required by the appropriate methods in the field and until receipt at the laboratory. Samples were packed in coolers along with the completed COC forms for shipment to analytical facilities as described in the Section 2.0. Coolers were securely packed with ice packs as required and sealed with signed and dated fiber tape for shipment.

#### **4.2.3 Navigation**

As described above, navigation was accomplished with a DGPS system. The accuracy of the DGPS coordinates were verified by positioning the vessel over the diffuser during a low slack tide when the boil was evident and comparing DGPS readings with the known outfall location. Intertidal stations were re-occupied using a hand-held DGPS, distance and bearings, and visual sightings to temporary benchmarks and landmarks. All station information was entered on the appropriate field logs and reviewed by the field leader.

#### **4.2.4 Field Instrumentation**

Field equipment used for collection, measurement, and testing was subject to a strict program of control, calibration, adjustment, and maintenance. Care was taken to ensure that the instruments used for field measurements of temperature, salinity, DO, and pH were calibrated and adjusted

with appropriate standards prior to and after each sampling event. The standards of calibration are in accordance with applicable criteria such as the U.S. Bureau of Standards, American Society of Testing and Materials (ASTM) Standards, and follow the instrumentation manufacturer's recommended procedures.

Temperature calibration was ensured by pre-calibration at the factory and field checks of the electronic temperature sensor against a research grade thermometer reading taken from the same sample at the same time. The electronic sensor for salinity (conductivity) was also pre-calibrated at the factory and field checked against six ambient water samples which were collected for the analysis of salinity (SM 2520B) to verify the proper operation of the probe. The DO probe was also pre-calibrated at the factory. For pH, the electronic sensor probe was pre-calibrated using three known buffer solutions.

#### **4.2.5 Sampling Variability**

Sampling variability was documented by sampling three replicates at one station for the water quality parameters. This included three replicate Niskin<sup>®</sup> bottle casts to obtain replicate turbidity samples and three replicate grabs at the surface for fecal coliform, color, and TRC analyses. In addition, triplicate casts of the CTD for pH, DO, temperature, and salinity were performed at one station in order to check reading variability from the probe's electronic sensors.

#### **4.2.6 Field Check Samples**

Field check samples include trip blanks for volatile organic analyses for EPA Methods 602 and 624, field blanks, field generated duplicates, and standard reference materials (SRMs), spikes or other samples of known concentration that may be sent to the laboratory. With the exception of the trip blanks which are initiated at the laboratory, most of these samples were sent to the laboratory as blind samples to ensure unbiased reporting of results.

### **4.3 LABORATORY QUALITY CONTROL**

Analytical quality control for this project included the following:

- adherence to documented procedures, particularly EPA methods, internal laboratory protocols, and respective laboratory QA/QC programs
- calibration of analytical instruments
- ability of each analytical laboratory to meet analytical precision, accuracy, limits of detection, and limits of quantification that meet EPA requirements
- use of quality control samples, internal standards, and surrogate solutions

The analytical laboratories used on this project operate under the quality assurance (QA) programs described in their QA management plans. These programs involve the participation of qualified and trained personnel; the use of standard operating procedures for analytical methodology and procedures; a rigorous system of documenting and validating measurements; maintenance and calibration of instruments; and the analysis of quality control samples for precision and accuracy tracking. The pertinent methods descriptions the laboratories are following are comprehensive and provide information concerning proper sample collection, processing, storage, and preservation; required apparatus and materials; analytical procedure;

standardization and calibration techniques; quality control samples required; methods of calculating values and assessing data quality; and reporting and performance criteria.

#### **4.3.1 Documentation**

Documentation in the laboratory included finalizing the original COC forms and generating the internal documents that track samples through the laboratory (e.g., sample control logs, refrigerator logs, etc.). Any deviations from the prescribed methods or internal laboratory standard operating procedures (SOPs) were documented in the project files. Data affected by such deviations were appropriately qualified, as was any data that did not meet acceptable quality criteria. Typical data qualifiers included those denoting estimated concentrations (J) or not detected (ND or U).

#### **4.3.2 Calibration**

Calibration is an integral part of any instrumental analysis. Calibration requirements for each type of analysis to be used on this project are described in the appropriate methods. Typically, instrument calibration was performed daily or on a per batch basis.

#### **4.3.3 Quality Control Procedures**

Internal laboratory quality control checks included the use of surrogate solutions and quality control samples such as procedural (or method) blanks, matrix spike/spike duplicates, standard reference materials (SRMs) or EPA QC check samples, and duplicates as specified in the EPA approved analytical procedures. Surrogate compounds were spiked into samples as appropriate to measure individual sample matrix effects that are associated with sample preparation and analysis. This includes QC samples such as procedural blanks and matrix spike samples. Surrogate compound analyses were reported in percent recovery. Results from quality control samples allow the assessment of quality assurance parameters such as accuracy and precision of the data. Any data falling outside the acceptable criteria as defined in the methods were appropriately investigated and qualified.

Method blanks are pure, organic- or metal-free reagent water that are run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. Method blanks were analyzed as called for by each method, typically one per day or one per sample batch.

Laboratory accuracy was assessed by routine spiking of environmental samples with a standard addition as called for by the appropriate method. Sample spikes and matrix spike/matrix spike duplicates were run on the organic analyses collected as part of both the influent, effluent, and sludge and receiving water monitoring components of the program. These samples are fortified with components of interest following the initial analysis to check the ability of the method to recover acceptable levels and to determine accuracy of the data. Quality control charts are prepared by the laboratories where applicable to show the range of individual measurements encountered by following procedures such as those outlined in *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (EPA, 1982b) and other guidance documents (e.g. EPA, 1994a and 1994b).

Trace metals analyses for the monitoring were supported through the use of standard reference materials (SRMs), which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards and other sources. These SRMs were analyzed by the laboratory at the same time as the program samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery.

Analytical and instrument variability was checked by laboratory splitting of one larger-volume field sample per survey into triplicates and analyzing the subsamples for the various water quality parameters. The individual measurements and concentration ranges were reported for each parameter of each split. In addition, duplicate analyses of samples split in the laboratory were used as a means to assess laboratory precision.

For other water quality parameters, the following summary of QA/QC procedures will apply:

- Fecal Coliform Bacteria: *Escherichia coli* was used as a positive control for each analytical run. *Pseudomonas aeruginosa* was used as a negative control, and buffered dilution water was used as a blank. In addition, 10 % of the samples were run in duplicate.
- Enterococci Bacteria: *Streptococcus faecalis* was used as a positive control for each analytical run. *Escherichia coli* was used as a negative control, and buffered dilution water was used as a blank.
- Color: Fresh color standards were made prior to the beginning of the program. Samples were allowed to settle and were pre-treated with paper filtration to remove turbidity and reported as "true color".
- Turbidity: The instrument was calibrated with a 20.0 standard provided by the manufacturer. Due to the high turbidity in Cook Inlet, all samples were diluted to 10 % prior to analysis to ensure that the measured turbidities were within the range of the instrumentation. In addition, select samples were run in duplicate.
- Total Residual Chlorine: TRC was run by amperometric titration which requires a blank and laboratory control and laboratory control spike samples every ten samples. The amperometric titrant was standardized daily.
- Salinity: A seawater salinity standard was used to check the instrumental accuracy of the salinometer every half-hour or every ten samples whichever is more frequent.

#### **4.3.4 Method Detection Limits**

The method detection limits (MDLs), practical quantification limits (PQLs), or method reporting limits (MRLs) for the various analytes were determined using the appropriate method as described in the protocols. These MDLs, PQLs, and MRLs have been reported with the data (see appendices) and included in summary data tables as appropriate. Concentrations below the MDL, PQL, or MRL were typically qualified with the "ND" code for non-detect.

## **4.4 DATA REVIEW AND VALIDATION**

Data were verified by performing comparisons of final data against the original documentation, including the workplan, field logs and data sheets, and analytical reports. Any discrepancies were fully documented in the program files and reported in the annual report. Data were validated according to accuracy, precision, and completeness for both the field sample collection and analytical laboratory components of the program. Qualitative evaluation and statistical procedures were used to check the quality of the field and chemical data as appropriate. The primary goals of these review and validation procedures are to ensure that the data:

- are representative of conditions in the study area
- are accurate
- demonstrate the required level of precision
- are comparable with data from other NPDES programs
- are acceptable for use as a tool to evaluate permit compliance
- allow independent technical appraisal of the program's ability to meet the monitoring objectives.

Analytical data were subjected to review upon receipt from the laboratory following guidelines such as those published in *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994a), or *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1994b). Items reviewed during data validation included sample holding times, results for laboratory method blanks, matrix spike/spike duplicates (MS/SD), check standards or SRMs, field and laboratory duplicates, field and trip blanks, report completeness, and laboratory performance (i.e., ability to achieve method detection limits and adherence to QA/QC criteria established for this program). Items failing to meet such validation and review procedures were noted and corrected, if possible. Items that could not be corrected and fell outside of acceptable limits (e.g., a sample analyzed outside holding time) have been noted in this annual report if they occur.

## **4.5 QUALITY ASSURANCE/QUALITY CONTROL RESULTS**

### **4.5.1 Field Instrumentation and Sampling Quality Control Results**

For influent, effluent, and sludge monitoring, field-generated duplicate influent and/or effluent samples were collected for the analysis of pesticides during the June 2004 sampling. During the August 2004 sampling, duplicate effluent samples were collected for metals (total and dissolved antimony, selenium, and thallium). Results for these duplicate analyses are provided in Table 11 and Table 12 and the appendices, and were found to be within acceptance limits. Results from duplicate field samples collected for certain parameters during the receiving water sampling such as volatile organics, metals, cyanide, turbidity, and TSS are reported in the appropriate tables (Table 17, Table 18, and Table 19), and were found to be within acceptance limits.

Field blanks were collected for several parameters during each sampling event by pouring HPLC-grade deionized (DI) water into the appropriate sampling containers with the correct preservative. Trip blanks consisted of DI blank samples prepared at the laboratory that went through the same shipping and handling procedures as all the other sample containers of each analytical type; these remained unopened in the field. Field blanks and trip blanks analyzed

using EPA Method 602 showed no measurable levels of the target compounds during the receiving water monitoring (Appendix D2). Trip blanks analyzed in conjunction with the EPA 624 analyses for June 2004 and August 2004 showed trace levels of methylene chloride, a common laboratory contaminant (Appendices A3 and B3). Additionally, the field blanks analyzed in conjunction with the EPA 624 analyses for both June 2004 and August 2004 showed trace levels of methylene chloride. This compound was also detected in the influent and effluent for both sampling events and in the laboratory method blank during August. Values reported for the influent and effluent for this parameter are qualified with the "B" qualifier to indicate laboratory contamination for the August 2004 data only (Table 11 and Table 12).

Sampling variability for water quality parameters (fecal coliform bacteria, color, turbidity, and TRC) was determined by analyzing three surface samples taken at Station C2-2S (Table 22). Where appropriate, the mean, standard deviation, and coefficient of variation are included in Table 22 to provide a measure of variability for the listed parameters. The coefficient of variation for the various sample types was found to be 0 % for color and TRC and 8.89 % for turbidity.

Three replicate fecal coliform samples were also collected at Station C2-2. Mean, standard deviation, and coefficient of variation were not determined for fecal coliform due to nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the  $\pm 95$  % confidence limits for each sample are provided. Sampling variability for fecal coliform was found to be within the 95 % confidence limits for all three samples.

Variability and calibration checks of the electronics probe were done by performing repeated profiles of temperature, pH, DO, and salinity at one station (C2-2). Results of these calibration checks for the Seabird CTD show that probe variability for temperature, pH, DO, and salinity was extremely low and in all cases with a coefficient of variation of  $<2.12$  % (Table 23). Salinity data obtained from the CTD were compared with salinity grab samples to confirm that the instrument was within calibration. In addition, a precision thermometer was used to verify CTD temperature readings, and the pH sensor was calibrated against three standards prior to field deployment at KLI's laboratory facilities. The salinity, temperature, and pH probes were found to be accurate and within calibration during the survey.

#### **4.5.2 Laboratory Quality Control Results**

Full analytical data are provided for each laboratory in the appendices. Laboratory duplicate analyses where performed were found to have a high degree of precision and were within the acceptance criteria for relative percent difference (RPD). Laboratory duplicates were performed for a number of organic analyses and were found to be within acceptance limits. A number of duplicate confirmation results, however, did exceed QC criteria and have been appropriately qualified in their respective tables. Malathion exceeded 40 % RPD between the primary and confirmation columns on the August influent sample and a number of pesticides exceeded the confirmation criteria during the bioaccumulation sampling and were appropriately qualified.

In addition to the standard laboratory QC procedures, color, fecal coliform, and turbidity, samples collected at Station C3-1 during the receiving water sampling were split in the laboratory and analyzed in triplicate. Mean, standard deviation, and coefficient of variation are reported in Table 22 for these samples (where appropriate). These statistics were not determined

**Table 22. Sampling and Laboratory Variability for Water Quality Samples, 23 and 24 June 2004.**

Station	Subsample Designation	Fecal Coliform* (MPN/100 mL)	Color (units)	Turbidity (NTU)	TRC (mg/L)
<b>SAMPLING VARIABILITY</b>					
C2-2S	A	2[1-10]	10	280	<0.005
	B	<2[---]	10	260	<0.005
	C	<2[---]	10	310	<0.005
Mean	---	---	10	283	<0.005
Standard Deviation	---	---	0	25.17	0
Coefficient of Variation	---	---	0	8.89	0
<b>LABORATORY VARIABILITY</b>					
C3-1S	A	<2[---]	15	480	<0.005
	B	<2[---]	10	510	NA
	C	<2[---]	10	490	NA
Mean	---	---	12	493	---
Standard Deviation	---	---	2.89	15.28	---
Coefficient of Variation	---	---	24.08	3.09	---
E2-3M	A	NA	NA	465	NA
	B	NA	NA	470	NA
Relative % Difference	---	---	---	1	---
E3-2S	A	NA	10	NA	NA
	B	NA	10	NA	NA
Relative % Difference	---	---	0	---	---
F1-2S	A	NA	NA	191	NA
	B	NA	NA	193	NA
Relative % Difference	---	---	---	1	---
F2-4B	A	NA	NA	553	NA
	B	NA	NA	568	NA
Relative % Difference	---	---	---	3	---
F3-2S	A	NA	10	NA	NA
	B	NA	10	NA	NA
Relative % Difference	---	---	0	---	---
F3-4B	A	NA	NA	493	NA
	B	NA	NA	498	NA
Relative % Difference	---	---	---	1	---
C2-2B	A	NA	NA	419	NA
	B	NA	NA	432	NA
Relative % Difference	---	---	---	3	---
C3-4B	A	NA	NA	417	NA
	B	NA	NA	423	NA
Relative % Difference	---	---	---	1	---

\* 95% confidence intervals indicated in brackets (American Public Health Association, 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. Washington, D.C. Table 9221.IV.)

NA Not analyzed

--- Not applicable



**Table 23. Seabird SEACAT SBE-19 CTD Probe Variability Check, 24 June 2004.**

Depth (M)	Temperature (°C)			Salinity (ppt)			pH (units)			DO (mg/l)			Mean (units)				Standard Deviation (units)				Coefficient Of Variation (%)			
C2-	2A	2B	2C	2A	2B	2C	2A	2B	2C	2A	2B	2C	Temp	Sal	pH	DO	Temp	Sal	pH	DO	Temp	Sal	pH	DO
1.0	14.67	14.63	14.62	9.64	9.29	9.31	7.97	7.97	7.97	10.17	10.25	10.26	14.64	9.41	7.97	10.23	0.029	0.199	0.003	0.048	0.20	2.11	0.03	0.47
2.0	14.66	14.61	14.60	9.65	9.39	9.39	7.97	7.97	7.97	10.24	10.26	10.27	14.62	9.48	7.97	10.26	0.030	0.151	0.002	0.015	0.20	1.60	0.03	0.15
3.0	14.64	14.60	14.60	9.65	9.45	9.41	7.97	7.97	7.97	10.25	10.28	10.27	14.61	9.50	7.97	10.27	0.027	0.132	0.002	0.014	0.19	1.38	0.03	0.14
4.0	14.64	14.59	14.59	9.64	9.49	9.43	7.97	7.97	7.97	10.24	10.28	10.27	14.61	9.52	7.97	10.27	0.028	0.112	0.002	0.021	0.19	1.17	0.03	0.20
5.0	14.63	14.58	14.58	9.66	9.46	9.45	7.97	7.97	7.97	10.25	10.28	10.27	14.60	9.52	7.97	10.27	0.030	0.118	0.002	0.018	0.20	1.24	0.03	0.17
6.0	14.60	14.58	14.56	9.66	9.49	9.47	7.97	7.97	7.97	10.27	10.28	10.24	14.58	9.54	7.97	10.26	0.019	0.102	0.002	0.021	0.13	1.07	0.02	0.20
7.0	14.57	14.57	14.55	9.66	9.51	9.47	7.97	7.97	7.97	10.27	10.27	10.23	14.57	9.55	7.97	10.26	0.012	0.099	0.001	0.025	0.09	1.03	0.01	0.25
8.0	14.57	14.55	14.54	9.66	9.52	9.50	7.97	7.97	7.97	10.28	10.24	10.21	14.56	9.56	7.97	10.24	0.016	0.084	0.002	0.033	0.11	0.88	0.02	0.32
9.0	14.58	14.53	14.52	9.69	9.53	9.51	7.97	7.97	7.97	10.28	10.21	10.18	14.54	9.58	7.97	10.23	0.028	0.096	0.003	0.051	0.19	1.00	0.03	0.50
10.0	14.57	14.53	14.51	9.66	9.54	9.50	7.97	7.97	7.97	10.27	10.21	10.15	14.54	9.57	7.97	10.21	0.031	0.080	0.001	0.061	0.22	0.84	0.01	0.60
11.0	14.57	14.53	14.49	9.67	9.54	9.52	7.97	7.97	7.97	10.28	10.20	10.10	14.53	9.58	7.97	10.19	0.038	0.082	0.001	0.088	0.26	0.85	0.01	0.86
12.0	14.56	14.51	14.48	9.67	9.55	9.55	7.97	7.97	7.97	10.26	10.17	10.02	14.52	9.59	7.97	10.15	0.044	0.069	0.000	0.122	0.30	0.72	0.00	1.20
13.0	14.55	14.50	14.47	9.69	9.58	9.53	7.97	7.98	7.97	10.24	10.12	10.00	14.51	9.60	7.97	10.12	0.040	0.081	0.003	0.120	0.27	0.84	0.03	1.18
14.0	14.53	14.48	14.46	9.70	9.59	9.50	7.97	7.98	7.98	10.21	10.07	9.92	14.49	9.59	7.97	10.06	0.039	0.102	0.001	0.145	0.27	1.06	0.01	1.44

for fecal coliform due to nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the  $\pm 95$  % confidence limits for each sample are provided in Table 22. Coefficient of variation was shown to be approximately 24.1 for color and 3.1 for turbidity. Fecal coliform values were within the confidence limits. For analyses where samples were run in duplicate, such as TRC, turbidity, and color samples, the relative percent difference between duplicates was calculated. Laboratory duplicate analyses were found to generally be very low and within acceptable limits. Duplicate results for turbidity ranged from 1 to 3 % RPD. Color duplicate results showed 0 % difference between duplicates. Due to an oversight in the field, duplicate TRC analysis was not performed except at the designated QC stations described above.

Laboratory accuracy was assessed through the use of surrogate recoveries, sample and control spikes and duplicates, and SRMs. Detailed QA/QC results for all contract laboratory analyses are provided in the appendices corresponding to each analysis. Surrogates are compounds that were added to each sample and QC sample that were analyzed by GC methodology, such as volatile organic compounds (EPA 602 and 624/8260B), semi-volatile organic compounds (EPA 625/8270C), pesticides (EPA 608/8081A and 614/8141A), and dioxins (EPA 8280A). Several instances of surrogate recoveries outside QC recovery limits were found during the 2004 sampling including, PCB sludge analysis (EPA 8082), pesticide water analysis (EPA 614), and pesticide sludge analysis (EPA 8141A) during June 2004 and semi-volatile sludge analysis (EPA 8270C), pesticide/PCB water analysis (EPA 608) and pesticide sludge analysis (EPA 8141A) during August 2004. Additionally, semi-volatile organic compounds (EPA 8270C) tissue data noted a control criteria exceedance in the method blank : Terphenyl-d14. No target analytes were detected above the MRL in the method blank. The data were not significantly affected.

Matrix spike (MS), matrix spike duplicate (MSD), laboratory control spike (LCS) and duplicate control spike (DCS) are samples and blanks that are spiked with target compounds of interest to determine percent recovery and relative percent difference between duplicates. The QC criteria include an acceptable recovery range and an RPD that should not be exceeded. Total metals, dissolved metals, cyanide, volatile organic compounds, and semi-volatile organic compounds met QC criteria with a few exceptions for MS, MSD, LCS, and DSC for all analyses on the program. Detailed case narratives were provided by each laboratory which fully detail all QC issues for both sampling efforts and explain any QC deviations; these are provided in Appendices A2, A3, B2, B3, E1, and E2.

Trace metals analyses for the influent, effluent, sludge, and receiving water testing were supported through the use of SRMs, which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards, National Institute of Standards and Technology, or other certified standards. These SRMs are analyzed by the laboratories at the same time as the project samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery. Except for nickel, copper and lead in the seawater SRM for the receiving water program, all metals SRM results were within acceptance limits. Nickel recovery was low in the SRM, however the matrix spike recovery and duplicate precision were well within acceptance limits. The low levels of this metal certified in the SRMs are at levels one to two orders of magnitude less than the receiving water limits of 8.2  $\mu\text{g/L}$  for nickel. Lead was found to have a high recovery in the seawater SRM which was found to fall within limits if it were blank corrected. These recovery problems were not seen in the 1640 SRM analysis performed

for these metals, and data quality was not judged to be adversely affected. In addition, SRMs were also analyzed for tissue samples, and TSS and cyanide receiving water samples and found to be within acceptance recovery limits (Appendices E1 and D1).

Method blanks (or procedural blanks) were also analyzed for most analyses on the program. Method blanks consist of pure, organic- or metal-free reagent water that is run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. With the exception of the ultra-trace level metals analyses that were conducted as part of the receiving water program and methylene chloride seen in the volatile organic analyses, all method blank results for the program showed no contamination during 2004. The method blank analyses for the ultra-trace level metals in the receiving water showed very small amounts of the various metals, most of which were present at levels below detection limits (Appendix D4). Nickel, copper and lead were the only metals which exceeded the detection limit. Copper concentration in the blank was an order of magnitude less than any of the dissolved concentrations found in the receiving water. The SRM results for copper fell within acceptance limits, and no further action was necessary. Lead was seen at a concentration of 0.0229 µg/L in the preconcentration blank, and the SRM results required blank correction to fall within acceptance limits. Therefore, the dissolved lead data were qualified with a “B” denoting blank contamination but are not blank corrected in this report.

Although the method blanks for the June 2004 volatile organic analyses (EPA 624) did not indicate any contamination, laboratory contamination may have occurred as methylene chloride was noted in both the trip and field blanks that consisted of HPLC grade DI water. The August 2004 summer wet influent, effluent, and sludge sampling also indicated methylene chloride contamination as it was seen in the method, field, and trip blank analyses. The method blank analyses performed with the TSS and cyanide analyses showed no results above method detection limits. In addition to the typical method blanks, buffered dilution water was used as a blank for fecal coliform and enterococci bacteriological analyses. All blanks run for fecal coliform and enterococci showed no growth. The method blank analyses performed with the organochlorine pesticide showed low levels of Methoxychlor above the MRL. In accordance with the laboratories QA/QC policy, all sample results less than twenty times the level found in the method blank were flagged as estimated concentrations.



## 5.0 DISCUSSION

### 5.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING

The NPDES permit for the Asplund WPCF requires compliance with applicable State water quality standards as promulgated in Chapter 70 of the Alaska Administrative Code entitled "Water Quality Standards" (18 AAC 70; ADEC, 1999). This chapter requires that criteria outlined in "EPA Quality Criteria for Water" (also known as "The Red Book"; EPA, 1976), the revised quality criteria for water (EPA 1986b), and other applicable criteria as referenced in the AWQS be met in applicable receiving waters at every point outside of the ZID boundary. Also, as noted in Section 1.1.1, the State of Alaska water quality regulations include SSWQC for the Point Woronzof area of Cook Inlet for turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, and silver. Since the issuance of the current Permit, with the exception of mercury and selenium, EPA has approved ADEC's proposed use of dissolved metals for all of the State's marine water quality criteria. Except for cadmium, where the dissolved standard changed from 9.3 to 8.8 µg/L, all other dissolved metals criteria are the same as those listed in the SSWQC. For mercury and selenium, EPA has taken no action at this time, so the current SSWQC will most likely remain in affect for the Point Woronzof area. Therefore, we have used the SSWQC and the more restrictive criteria for dissolved cadmium to evaluate the data in this report. Finally, the permit itself includes some effluent limitations that must be met. The following sections discuss the parameters of concern in regards to the requirements of the NPDES permit or the AWQS as well as historical data from the WPCF, data from other publicly-owned treatment works (POTWs), or other EPA data.

#### 5.1.1 Influent and Effluent Monitoring

Table 24 lists permit effluent limitations and water quality criteria that are applicable to the current NPDES permit; it includes each of the parameters required to be monitored by the permit. Most of the values shown are the chronic toxicity criteria for salt water aquatic life. Chronic toxicity criteria concentrations are lower than acute toxicity criteria concentrations; therefore, the more stringent of the two values were used here for comparison. The MAEC for each constituent was calculated from the outfall design dilution factor of 142:1 (for conservative substances) or 180:1 (for non-conservative substances), the water quality criteria, and the natural background concentrations as determined at the control site near Point MacKenzie. It was assumed that the final effluent would be diluted by a minimum factor of 142 by the time it reached the boundary of the ZID. For most metals, the MAECs were calculated from the SSWQC for dissolved metals contained in the AWQS for the Point Woronzof area.

To determine compliance with State water quality standards, Table 24 can be compared with effluent values found in Table 11 through Table 13 as well as those in Table 18 and Table 19. The AWWU 2004 maximum effluent concentrations shown in Table 24 were the maximum encountered during the calendar year either during AWWU's in-plant monitoring, the toxic pollutant and pesticide monitoring events, pretreatment monitoring, or the receiving water sampling event. For metals, both total and dissolved concentrations in the effluent were compared against their MAEC, since it is assumed that all of the metals contained in the effluent are potentially bioavailable upon entering the receiving water. All effluent concentrations were found to be much lower than the MAECs from the permit or computed from the water quality standards provided for in the AWQS. In addition, the permit limitations for all but one

**Table 24. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2004 Maximum Concentrations for Effluent Comparisons.** Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>		Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2004 Maximum Effluent Concentration <sup>c</sup>
Antimony (µg/L)	146	Human health, not listed for saltwater aquatic life	20,607	ND (10) <sup>d</sup>
Arsenic (µg/L)	36	Chronic toxicity, measured as dissolved	4,882	2.0 <sup>e</sup>
Beryllium (µg/L)	11	For the protection of aquatic life in soft fresh water	1,513	0.3 <sup>e</sup>
Cadmium (µg/L)	9.3 (8.8) <sup>k</sup>	Chronic toxicity, measured as dissolved	1,322 (1,250)	ND(6.2) <sup>d,e</sup>
Chromium (VI) <sup>h</sup> (µg/L)	50	Chronic toxicity, measured as dissolved	7,038	ND(6.2) <sup>d,e</sup>
Copper (µg/L)	3.1	Chronic toxicity, measured as dissolved	317	70.9 <sup>f</sup>
Lead (µg/L)	8.1	Chronic toxicity, measured as dissolved	1,140	12 <sup>d,e</sup>
Mercury (µg/L)	0.025	Chronic toxicity, measured as dissolved	2.73	0.70 <sup>d,e</sup>
Nickel (µg/L)	8.2	Chronic toxicity, measured as dissolved	978	7 <sup>e</sup>
Selenium (µg/L)	71	Chronic toxicity, measured as dissolved	10,136	ND (10) <sup>d</sup>
Silver (µg/L)	1.9	Acute toxicity, measured as dissolved	257	3.9 <sup>d,e</sup>
Thallium (µg/L)	2,130	Acute toxicity to saltwater aquatic life	306,567	ND (10) <sup>d</sup>
Zinc (µg/L)	81	Chronic toxicity, measured as dissolved	11,249	150 <sup>e</sup>

**Table 24. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2004 Maximum Concentrations for Effluent Comparisons. (continued)**  
Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>		Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2004 Maximum Effluent Concentration <sup>c</sup>
Cyanide (µg/L)	1	For marine aquatic life	181	10 <sup>e</sup>
Total Aqueous Hydrocarbons (TAQH) (µg/L)	15	Growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers	2,715	12.8 <sup>f</sup>
Total Aromatic Hydrocarbons as BETX (µg/L)	10	Same as above	1,810	27.2 <sup>d</sup>
pH (pH units)		<sup>g</sup>	6.5 - 8.5	6.6 – 8.1 <sup>i</sup>
Total Residual Chlorine (TRC) (mg/L)		<sup>g</sup>	Daily Max. 1.2	Daily Max 1.0 <sup>i</sup>
BOD <sub>5</sub> (mg/L)		<sup>g</sup>	Monthly Avg. 240	Monthly Avg. 168 <sup>i</sup>
			Weekly Avg. 250	Weekly Avg. 192 <sup>i</sup>
			Daily Max. 300	Daily Max. 228 <sup>i</sup>
			Removal Rate ≥ 30 %	Monthly Avg. Rate <b>29-39%</b> <sup>i</sup>

**Table 24. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2004 Maximum Concentrations for Effluent Comparisons. (continued)**  
Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>	Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2004 Maximum Effluent Concentration <sup>c</sup>
Total Suspended Solids (TSS) (mg/L)	<sup>g</sup>	Monthly Avg. 170 Weekly Avg. 180 Daily Max. 190 Removal Rate $\geq$ 30%	Monthly Avg. 51 <sup>i</sup> Weekly Avg. 67 <sup>i</sup> Daily Max. 96 <sup>i</sup> Monthly Avg. Rate 75-82% <sup>i</sup>
Total Ammonia (mg/L)	9.8 <sup>j</sup>	1,774	Monthly Max. 24.2 <sup>i</sup>
Fecal Coliform (FC MPN/100 mL)	<sup>g</sup>	Monthly geometric mean of at least five samples shall not exceed 850. Not more than 10% of samples shall exceed 2600.	<b>Monthly geometric mean for August 2004 was 1213. More than 10% of the samples collected in January, March, July, August, and September 2004 exceeded 2600.</b> <sup>i</sup>

<sup>a</sup> Alaska Administrative Code, 1999. Water Quality Standards, Chapter 70 (18 AAC 70)

<sup>b</sup> For conservative substances, effluent water quality criteria were determined by assuming a dilution of 142:1 at the ZID boundary, where: MAEC = 142 \* (Criteria - Natural Background Concentration) + Criteria; pollutant concentrations in the effluent should not exceed these values. For non-conservative substances, a dilution of 180:1 was utilized in the MAEC calculation.

<sup>c</sup> For metals, the maximum effluent concentration was determined from both total and dissolved concentrations.

<sup>d</sup> Values from June 2004 or August 2004 toxic pollutant and pesticide samplings.

<sup>e</sup> Values from AWWU's pretreatment program.

<sup>f</sup> Values from effluent tested during receiving water sampling event.

<sup>g</sup> MAECs are not based on water quality criteria but instead are specified in MOA's 2000 NPDES permit.

<sup>h</sup> All samples tested as total chromium.

<sup>i</sup> Values from AWWU's in-plant monitoring.

<sup>j</sup> Ammonia receiving water criteria based on pH of 8.0, temperature of 15.0 °C, and salinity of 20 ‰.

<sup>k</sup> Cadmium standard based on new revised EPA level that was approved for State of Alaska.



parameter (fecal coliform) were met for the 2004 program year. Individual parameters are discussed more fully below. When the MAECs in Table 24 were compared to AWWU's self-monitoring effluent data, the toxic pollutant and pesticides sampling events (June 2004 and August 2004), the pretreatment monitoring data, and the effluent data from the receiving water quality sampling event, no metals or cyanide values exceeded their MAECs. The highest concentrations of either total or dissolved metals seen in 2004 were all well below their respective MAECs. The two metals that most closely approached their MAECs at any time were copper and mercury, and both of these were still seen at levels considerably below their MAECs. The maximum concentration of total copper was 70.9 µg/L compared to an MAEC of 317 µg/L. The highest dissolved copper concentration that was seen was 55 µg/L. The maximum concentration of total mercury seen was 0.70 µg/L, while the highest dissolved mercury was below detection limits (<0.06 µg/L) compared to an MAEC of 2.73 µg/L.

Those metals without SSWQC, while analyzed as both total and dissolved metals as called for by the permit, are compared to total recoverable metal MAECs as provided by EPA criteria and as called for by the AWQS. Total metals concentrations for antimony, beryllium, and thallium were generally low, often below detection limits, and all well below their MAECs. As in past years, total recoverable metals detected in the influent and final effluent of the Asplund WPCF were compared with data from an EPA study of 40 Publicly Owned Treatment Works (POTWs) in Table 25 (EPA, 1982a). Without exception, metals and cyanide values were lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants.

Historic influent and effluent total recoverable metals and cyanide concentrations collected as part of AWWU's self-monitoring program are presented in Table 26 and Table 27. It should be noted that under the previous permit, the reporting year was November - October, which differs from the current permit's reporting period of the calendar year. In addition, prior to 2000 when the permit requirements changed, dissolved metals had only been analyzed in a single sample of effluent collected each year during the receiving water sampling. Beginning in August 2000, dissolved metals from the effluent have been analyzed in both the summer wet and summer dry sampling events. With few exceptions, concentrations are fairly consistent over time. Concentrations of total recoverable metals and cyanide concentrations seen in the influent and effluent during 2004 were generally found to fall within the range of concentrations seen during prior years. Concentrations of dissolved metals were generally found to fall within range of concentrations seen since August 2000 when this type of analysis was initiated.

During previous years, total copper levels would sometimes exceed the previous permit's MAEC of 100 µg/L. While this permit limit is no longer in effect, it is interesting to note that the maximum total copper concentration encountered in the effluent during the year 2004 (from the pretreatment monitoring) was considerably lower at 68 µg/L. The reasons for the elevated copper concentrations in previous years were investigated and reported to the Municipality by CH2M Hill and the AWWU laboratory. The conclusion of the copper investigation was that most of the copper in the influent is from the leaching of copper from residential plumbing rather than industrial discharge (CH2M Hill, 1987; CH2M Hill et al., 1988). Neither enforcement of the sewer ordinance (AMC 26.50) nor the industrial pretreatment program was expected to significantly reduce the amounts of copper received at the Asplund WPCF. The mass of copper in the plant influent and effluent remained fairly constant from 1986 through 1991. From 1991

**Table 25. Comparison Between Influent/Effluent Analysis Results for Anchorage and 40 POTWs.<sup>a</sup>**

Parameter	Anchorage Values				40 POTW Study Values				
	2004 Concentration <sup>b,c</sup> (µg/L)				Frequency of Detection (%)		Range Detected (µg/L)		Influent Median
	Summer-Dry		Summer-Wet		Influent	Secondary Effluent	Influent	Secondary Effluent	(µg/L)
	INF	EFF	INF	EFF					
VOLATILES									
Benzene	ND	ND	ND	ND	61	23	1-1560	1-72	2
Chloroform	2.5 J	3.2 J	2.7 J	3.6 J	91	82	1-430	1-87	7
1,4 Dichlorobenzene	ND	ND	ND	ND	17	3	2-200	3-9	NA
Ethylbenzene	ND	ND	ND	ND	80	24	1-730	1-49	8
Methylene chloride	2.4 J	4.4 J	4.2 B, J	4.7 B, J	92	86	1-49000	1-62000	38
Tetrachloroethene	ND	ND	8.3	ND	95	79	1-5700	1-1200	23
Toluene	6.2	5.9	7.1	7.2	96	53	1-13000	1-1100	27
Xylene (Total)	ND	ND	ND	ND	NA	NA	NA	NA	NA
SEMI-VOLATILES <sup>d</sup>									
Bis(2-ethylhexyl)phthalate	12	16	15	15	92	84	2-670	1-370	27
Butyl benzyl phthalate	2.1 J	ND	5.6 J	4.2 J	57	11	2-560	1-34	3
Diethyl phthalate	8.5 J	8.5 J	7.9 J	7.4 J	53	13	1-42	1-7	3
Di-n-butyl phthalate	1.5 J	1.7 J	ND	ND	64	52	1-140	1-97	4
1,4 Dichlorobenzene	ND	ND	1.1 J	ND	17	3	2-200	3-9	NA
Phenol	30	19	31	19	79	29	1-1400	1-89	7
TOTAL METALS & OTHER COMPONENTS									
Antimony	1.1	ND	ND	ND/ND	14	13	1-192	1-69	NA
Arsenic	2	ND	ND	ND	15	12	2-80	1-72	NA
Beryllium	0.2	0.2	0.2	0.1	3	1	1-4	1-12	NA
Cadmium	ND	ND	ND	ND	56	28	1-1800	2-82	3
Chromium	5	4	ND	ND	95	85	8-2380	2-759	105
Copper	76	63	85	65	100	91	7-2300	3-255	132
Lead	12	12	6	4	62	21	16-2540	20-217	53
Mercury	0.41	0.11	0.17	0.70	70	31	0.2-4	0.2-1.2	0.517
Nickel	7	5	ND	ND	79	75	5-5970	7-679	54
Selenium	ND	ND	ND	ND/ND	9	10	1-10	1-150	NA
Silver	5.6	3.9	ND	ND	71	25	2-320	1-30	8
Thallium	ND	ND	ND	ND/ND	3	2	1-19	1-2	NA
Zinc	180	140	165	76	100	94	22-9250	18-3150	273
Cyanide	ND	ND	ND	ND	100	97	3-7580	2-2140	249

<sup>a</sup> Source: EPA, 1982. *Fate of Priority Pollutants in POTWs*. Final Report, Volume I, Effluent Guidelines Division, WH-552, EPA 440/1-82/303

<sup>b</sup> Data from NPDES 2004 toxic pollutant and pesticide monitoring

<sup>c</sup> Duplicate analyses provided for some analyses (value/field duplicate value)

<sup>d</sup> Only analytes detected above the detection limit in either the influent or effluent are included

B Also detected in associated method blank

J Estimated value

NA Not available

ND Not detected

**Table 26. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years.** Values in brackets are from EPA Method 602 where available.

Pollutant	1999		2000		2001	
	Dry <sup>c</sup>	Wet <sup>c</sup>	Dry <sup>c</sup>	Wet <sup>c</sup>	Dry <sup>c</sup>	Wet <sup>c</sup>
	6/8-9	8/24-25	6/6-7	8/14-15	6/19-20	9/4-5
<b>ORGANICS (µg/L)</b>						
Benzene	ND[0.58/0.57]	3.0[ND/ND]	ND[ND/ND]	4.3[5.3/5.3]	1.62[ND/ND/ND]	1.99[ND/ND]
* Benzoic Acid	NT	NT	NT	NT	ND	109
Bis-(2-ethylhexyl) phthalate	11 J	21 B/ND <sup>e</sup>	ND	10	22.9	272
Bromomethane	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	3.6 J	ND	ND	ND	ND	ND
Chloroform	2.8	5.4	3.8	3.3	2.98	3.60
*1,2-Dichlorobenzene	ND/ND[17/ND]	ND/ND/ND[ND/2.9]	ND/ND[ND/11]	ND/ND[9.5/8.0]	ND/ND[6.2/5.6/6.0]	ND/ND[ND/ND]
*1,3-Dichlorobenzene	1.1/ND[ND/ND]	ND/ND/ND[ND/ND]	1.8/ND[10/11]	ND/ND[ND/ND]	ND/ND[4.5/4.4/4.6]	1.27/ND[ND/ND]
*1,4-Dichlorobenzene	1.1/ND[6.8/7.1]	1.6/ND/ND[4.4/3.4]	ND/ND[15/24]	ND/ND[7.1/6.3]	ND/ND[1.1/1.1/1.1]	ND/ND[1.7/1.7]
Diethyl phthalate	8.0 J	ND	ND	ND	ND	12.6
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND	ND	ND
Ethylbenzene	1.6[4.2/4.2]	2.6[ND/ND]	1.0[ND/ND]	4.1[6.5/6.3]	ND[ND/ND/ND]	2.40[ND/ND]
Methylene Chloride	6.8	5.7	3.8	1.8	ND	ND
Phenol	ND	ND/49 <sup>e</sup>	ND	ND	ND	ND
Tetrachloroethene	1.6	1.4	1.3	1.4	2.16	2.34
Toluene	12[18/17]	32[8.5/8.4]	10[7.0/6.8]	27[23/23]	9.37[4.2/4.0/4.2]	8.95[8.0/7.7]
* Total Xylenes	NT[28/28]	NT[2.6/2.4]	NT[10/6.3]	NT[37/37]	2.42[ND/ND/ND]	12.51[ND/ND]
Total Hydrocarbons as Oil and Grease <sup>a</sup>	7800/7200	11000	21200	20300	21200	20400
Total Petroleum Hydrocarbons <sup>b</sup>	ND/ND	ND	ND/ND	ND	NT	NT
Total Aromatic Hydrocarbons as BETX <sup>f</sup>	14.6[50.8/49.8]	37.6[12.1/11.8]	12.0[18/14.1]	35.4[71.8/71.6]	13.6[5.7/5.5/5.7]	25.8[11.0/10.7]

**Table 26. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602 where available.

Pollutant	2002		2003		2004	
	Dry <sup>c</sup>	Wet <sup>c,d</sup>	Dry <sup>c</sup>	Wet <sup>c</sup>	Dry	Wet
	7/22-23	8/26-27	6/25-26	8/12-13	6/23-24	8/23-24
<b>ORGANICS (µg/L)</b>						
Benzene	ND[0.58/0.59]	ND[ND/ND]	ND[ND/ND]	ND[ND/ND]	ND[0.24 J]	ND
* Benzoic Acid	NT	NT	NT	NT	NT	NT
Bis-(2-ethylhexyl) phthalate	11	8.9 J/21	18 B	13	16	15
Bromomethane	ND	ND	7.0 J	ND	ND	ND
Butyl benzyl phthalate	3.3 J	ND/ND	3.0 J	ND	ND	4.2 J
Chloroform	4.3 J	4.8 J	3.8 J	3.2 J	3.2 J	3.6 J
* 1,2-Dichlorobenzene	ND	ND	ND[ND/ND]	ND[ND/ND]	ND	ND
* 1,3-Dichlorobenzene	ND	ND	ND[ND/ND]	ND[ND/ND]	ND	ND
* 1,4-Dichlorobenzene	ND	ND	ND[ND/ND]	ND[1.2/1.2]	ND	ND
Diethyl phthalate	8.9 J	6.0 J/7.5 J	7.3 J	11	8.5 J	7.4 J
Di-n-butyl phthalate	2.9 J	ND/ND	1.6 J	ND	1.7 J	ND
Di-n-octyl phthalate	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND [0.62/0.61]	ND[0.80/0.81]	ND[1.8/1.1]	ND[1.1/1.3]	ND[0.37 J, COL]	ND
Methylene Chloride	5.0 B	0.94 J	4.1 J	2.9J	4.4 J	4.7 J,B
Phenol	24	11/ND	18	23	19	19
Tetrachloroethene	ND	0.95 J	ND	ND	ND	ND
Toluene	9.1[11/10]	8.2[6.2/6.4]	7.4[5.8/6.4]	5.3[9.0/9.6]	5.9[6.4]	7.2
* Total Xylenes	NT[3.0/2.8]	NT[5.7/5.8]	5.1 J[6.9/8.3]	ND[14/15]	ND[1.3 COL]	ND
Total Hydrocarbons as Oil and Grease <sup>a</sup>	21800	23500	24000	20100	26300	25400
Total Petroleum Hydrocarbons <sup>b</sup>	NT	NT	NT	NT	NT	NT
Total Aromatic Hydrocarbons as BETX <sup>f</sup>	NT[15.2/14]	18.2[13.2/13.5]	22.5[15.5/16.8]	25.3[24.6/26.4]	25.9[8.31]	27.2

**Table 26. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602 where available.

Pollutant	1999		2000		2001	
	Dry	Wet	Dry <sup>c</sup>	Wet <sup>c</sup>	Dry <sup>c</sup>	Wet <sup>c</sup>
	6/8-9	8/24-25	6/6-7	8/14-15	6/19-20	9/4-5
<b>TOTAL METALS (µg/L)</b>						
Antimony	ND	ND	ND	ND	ND	ND/ND
Arsenic	3	3	ND	3	ND	ND
Beryllium	ND	ND	ND	ND	ND	ND
Cadmium	ND	15	ND	ND	0.3	0.3
Chromium	ND	ND	ND	10	4.1	3.2
Copper	70	50	54	53	56	39
Lead	5	3	4.8	8	6	6
Mercury	0.2	ND	0.1	ND	0.2	0.1
Nickel	20	ND	ND	ND	3	4
Selenium	NT	ND	ND	ND	ND	ND/ND
Silver	8.9	8.4	5.3	5.3	10.7	6.0
Thallium	ND	ND	ND	ND	ND	ND/ND
Zinc	78	95	77	80	70	60
<b>DISSOLVED METALS (µg/L)</b>						
Antimony	NT	NT	NT	ND	ND	ND/ND
Arsenic	NT	NT	NT	3	ND	7
Beryllium	NT	NT	NT	ND	ND	ND
Cadmium	NT	NT	NT	6	ND	0.3
Chromium	NT	NT	NT	ND	0.6	ND
Copper	NT	NT	NT	39	28	28
Lead	NT	NT	NT	7	3	3
Mercury	NT	NT	NT	ND	ND	ND
Nickel	NT	NT	NT	20	4	4
Selenium	NT	NT	NT	ND	ND	ND/ND
Silver	NT	NT	NT	0.4	1.5	0.9
Thallium	NT	NT	NT	ND	ND	ND/ND
Zinc	NT	NT	NT	50	20	50
<b>PESTICIDES (µg/L)</b>						
Aldrin	ND	ND	ND/ND/ND	ND/ND	ND/ND/ND	ND
alpha-BHC	ND	0.067	ND/ND/ND	ND/ND	ND/ND/ND	ND
delta-BHC	ND	ND	ND/ND/ND	ND/ND	ND/ND/ND	ND
4,4'-DDE	ND	ND	ND/ND/ND	0.020/ND	0.04/ND/ND	ND
Malathion	0.13	6.7	ND/ND/ND	ND/ND	ND/ND/ND	ND
Parathion	ND	0.56	ND/ND/ND	ND/ND	ND/ND/ND	ND
<b>OTHER</b>						
Cyanide (µg/L)	ND	ND	10	10.8	ND	ND
Asbestos (million fibers/L)	ND	ND	ND	46	20	13

**Table 26. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602 where available.

Pollutant	2002		2003		2004	
	Dry	Wet <sup>c</sup>	Dry	Wet <sup>c</sup>	Dry	Wet <sup>c</sup>
	7/22-23	8/26-27	6/25-26	8/12-13	6/23-24	8/23-24
<b>TOTAL METALS (µg/L)</b>						
Antimony	ND	ND/ND	ND	ND/ND	ND	ND/ND
Arsenic	3	ND	3	5	ND	ND
Beryllium	ND	ND	ND	0.07	0.2	0.1
Cadmium	ND	0.4	ND	0.7	ND	ND
Chromium	1.5	3.0	7	2	4	ND
Copper	60.4	61	60	49	63	65
Lead	6	9.0	7	2	12	4
Mercury	ND	ND	0.13	0.1	0.11	0.70
Nickel	4	3	1	5	5	ND
Selenium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Silver	6.4	6.0	3.3	2.8	3.9	ND
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	139	80	70	69	140	76
<b>DISSOLVED METALS (µg/L)</b>						
Antimony	ND	ND/ND	ND	ND/ND	ND	ND/ND
Arsenic	ND	3	ND	4	ND	ND
Beryllium	ND	0.46	ND	ND	ND	0.1
Cadmium	0.5	0.2	ND	0.9	0.6	ND
Chromium	ND	1.7	ND	1	ND	ND
Copper	34.9	39	27	39	27	49
Lead	5	1	7	ND	4	8
Mercury	ND	ND	0.05	ND	ND	ND
Nickel	6	3.0	3	3	6	ND
Selenium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Silver	0.5	1.1	0.6	ND	ND	0.6
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	87	40	30	69	40	12
<b>PESTICIDES (µg/L)</b>						
Aldrin	ND	0.081	ND	ND	ND	ND
alpha-BHC	ND	0.10	ND	ND	ND	ND
delta-BHC	ND	0.86	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND	ND	ND
Malathion	ND	ND	0.31	ND	ND	ND
Parathion	ND	ND	ND	ND	NT	NT
<b>OTHER</b>						
Cyanide (µg/L)	ND	ND	ND	ND	ND	ND
Asbestos (million fibers/L)	20	6.6	ND	ND	ND	ND

*a* EPA method 1664 HEM (1999 - 2004)

*b* EPA method 1664 SGT-HEM (1999; 2000)

*c* Duplicate effluent collected (field duplicate) or analyzed (lab duplicate) shown as value/duplicate value

*d* Values from EPA Method 624 are the result of averaging eight samples with zero used for ND (2002 Wet)

*e* First EPA 625 sample run showed contamination in method blank; second run (outside holding time) also reported (1999 Wet)

*f* BETX calculated from EPA 624 for years 1999-2000 do not include xylenes as they were not tested

\* Non-priority pollutants

B Compound also detected in method blank

COL More than 40% RPD between primary and confirmation results. The lower of the two results is reported.

J Estimated value

ND Not detected

NT Not tested

**Table 27. Historical Discharge Monitoring Data (1986 - Present) for Influent and Effluent Total Metals and Cyanide.**  
Concentrations are in µg/L. Values represent a range of minimum (Min) and maximum (Max) results for 1986-1998 as available and the average (Avg), Min, and Max for 1999 (program year running Nov. - Oct.). Results for 2000 include Avg, Min, and Max of seven monthly values (Jan. - July) and pretreatment monitoring values (Avg of three results in August 2000). Results for 2001-2004 are from pretreatment monitoring (Avg of six results from both the wet and dry sampling events).

Year	Average Flow (MGD)	Arsenic		Beryllium		Cadmium		Copper		Lead		Mercury		Nickel		Silver		Zinc		Chromium		Cyanide	
		Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.
1986-1998 Min	23	<1	<1	<0.1	<0.1	<0.5	<0.5	36	10	<1	<1	<0.2	<0.1	<1	<1	3	1	54	38	<1	<1	<0.4	1
1986-1998 Max	40	26	16	0.3	0.2	20	30	280	150	76	50	3.0	1.5	77	60	30	98	260	240	112	120	85	50
1999 Avg	29	4	3	0.2	0.2	6	6	91	57	22	7	0.5	0.2	28	22	7.1	4.9	142	77	11	12	<10	13
1999 Min	27	2	2	<0.1	<0.1	<5	<5	78	40	8	2	<0.1	<0.1	<20	<20	3.8	1.5	103	45	<10	<10	<10	<10
1999 Max	33	6	6	0.4	<0.4	17	10	120	70	149	15	1.5	0.4	50	40	12.6	7.9	197	114	20	20	<10	30
2000 Avg	29	6	3	<0.1	<0.1	<5	<5	84	46	11	8	0.3	<0.1	20	20	13.0	6.0	130	70	<10	<10	<10	<10
2000 Min	27	3	<3	<0.1	<0.1	<5	<5	60	30	6	<1	<0.1	<0.1	<20	<20	2.1	2.4	80	50	<10	<10	<10	<10
2000 Max	34	19	4	<0.1	<0.1	9	10	129	60	24	27	0.6	0.2	40	50	30.4	10.5	170	100	10	10	<10	10
2001 Avg	28	4	3	0.04	0.03	0.6	0.4	84	48	14	8	0.3	0.1	7	4	11.4	7.2	140	70	5	3.5	<10	<10
2001 Min	26	<3	3	<0.03	<0.03	0.4	0.2	82	39	8	4	0.2	<0.1	4	3	10.2	5.5	130	60	3.4	3.0	<10	<10
2001 Max	30	5	5	0.06	<0.03	0.7	1.0	88	56	27	19	0.4	0.2	10	6	12.9	10.7	150	80	6.2	4.1	<10	<10
2002 Avg	29	4	3	0.12	.082	0.5	0.4	92	63	10	6	0.4	0.1	6	4	9	6	165	158	4	3	10	10
2002 Min	27	<3	<3	0.06	<0.04	0.4	0.4	77	59	7	5	0.1	<0.1	5	3	7	4	110	80	3	1.5	<10	<10
2002 Max	34	4	3	0.22	0.21	0.6	<0.5	108	68	12	9	1.6	0.1	9	5	13	11	239	407	6.7	4.1	<10	<10
2003 Avg	28	3	3	0.09	0.09	0.8	0.6	88	57	11	5	0.3	0.1	4	5	5.6	3.3	133	79	5	3	<10	<10
2003 Min	26	1	1	0.07	0.07	0.5	<0.5	79	49	5	2	0.2	0.1	2	<1	4.3	2.7	100	69	2	2	<10	<10
2003 Max	31	5	5	0.11	0.11	1.0	0.7	110	65	19	7	0.4	0.2	6	13	6.7	3.9	151	100	9	7	<10	<10
2004 Avg	29	3	2	0.2	0.2	0.4	<0.3	83	58	10	6	0.4	0.2	7	5	5.9	3.2	169	120	5	4	<10	<10
2004 Min	26	<2	<2	0.1	0.1	<0.3	<0.3	71	46	6	4	0.1	0.1	<6.2	<6.2	<1.5	<1.5	140	76	<6.2	<6.2	<10	<10
2004 Max	34	4	2	0.2	0.3	<6.2	<6.2	99	68	12	12	0.9	0.7	8	<6.2	7.2	3.9	192	150	<6.2	<6.2	<10	10

Inf. Influent  
Eff. Effluent

to 1992, the in-plant copper loading dropped by approximately 25 %. The exact cause of this decrease is unknown; however, an increase in pH (to approximately 8.0) at the Water Treatment Facilities (Ship Creek and Eklutna) during the spring of 1991 caused a decrease in copper concentrations taken from "first draw" residential water sources in Anchorage. This increase in alkalinity was implemented to reduce corrosion in the drinking water distribution system. It would follow that these decreased values in drinking water would also affect the influent concentrations.

Total arsenic concentrations in the final effluent had remained fairly steady over the last five years, and 2004 values remained well within the range of those values seen before. The maximum total arsenic concentration in final effluent seen during 2004 was 2.0 µg/L, compared to an MAEC of 4,882 µg/L (Table 24). Arsenic values are not a serious concern for this permit in terms of effluent concentrations, since the concentration in the final effluent is so much lower than the MAEC.

During 2004, 10 µg/L of cyanide was reported in the effluent during the pretreatment monitoring efforts well below the MAEC of 181 µg/L. The concentrations of cyanide in the effluent were <10 µg/L during the June 2004 and August 2004 samplings. Cyanide concentrations in the effluent collected during the receiving water sampling were reported as 1.4 µg/L. Cyanide had been a constituent of concern in past years because it approached or even exceeded the prior MAEC of 50 µg/L in some years. In 1986 it was observed that the effluent cyanide concentrations often exceeded the influent concentrations by an order of magnitude. This trend continued during subsequent years of sampling and was the subject of a special investigation conducted by the AWWU. The conclusion of this investigation was that the measured increase in cyanide between the influent and effluent was the result of the treatment plant's incinerator. Cyanide formed in the incinerator during sludge incineration is returned to the plant during the stack scrubbing process (CH2M Hill, 1987; CH2M Hill in association with Loren Leman, P.E., 1988). Subsequently, cyanide decreased and this was believed to be due to the change in the scrubbing water source from recirculated primary effluent to well water.

The most restrictive criteria of growth and propagation of fish, shellfish, other aquatic life, and wildlife was used for the hydrocarbon limits presented in Table 24. The MAECs for TAqH and total aromatic hydrocarbons as BETX were met again this year, with maximum levels in the effluent well below the state-specified limits. The parameter of TAqH was analyzed in effluent only during the receiving water quality sampling, and the TAqH concentration was 12.8 µg/L as compared to the MAEC of 2,715 µg/L. The maximum BETX value measured by the EPA 624 method of 27.2 µg/L was seen during the toxic pollutant and pesticide August 2004 sampling, and this value fell well below the MAEC of 1,810 µg/L.

The MAEC for total ammonia was met this year, with effluent values exhibiting a maximum of 24.2 mg/L as compared to the MAEC of 1,774 mg/L. This MAEC is based on maximum criteria in saltwater of 9.8 mg/L based on a salinity of 20 ppt, temperatures of 15°C, and a pH of 8.0 units (EPA, 1989).

In addition to the MAECs based on the State and Federal water quality criteria, a number of other effluent limitations are specified in the NPDES permit. These daily, weekly, and monthly limitations include pH, TRC, BOD<sub>5</sub>, TSS, and fecal coliform (Table 24). All of the parameters except fecal coliform were found to be within their permit limitations for 2004.



For fecal coliform, the permit limitation of a monthly geometric mean (of at least five samples) that shall not exceed 850 FC MPN/100 mL was exceeded in August 2004, when the monthly geometric mean was reported as 1,213 FC MPN/100 mL. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in January, March, July, August, and September 2004. Exceedances resulted from the continuing adjustment of the ORP chlorine feed control system in an effort to optimize chlorine use. No other permit exceedances were noted during this reporting period.

The permit limitations for monthly and weekly averages and daily maximum were met for BOD<sub>5</sub> and TSS. Although not a permit limit, amendments to the Clean Water Act (40 CFR; Final Rule, 8/9/94), require at least 30 % removal for both of these parameters. BOD<sub>5</sub> and TSS met this requirement on an average annual basis; however on a average monthly basis, BOD<sub>5</sub> removal was 29 % in January. All other months met the 30 % removal requirement for both BOD<sub>5</sub> and TSS. Removal of BOD<sub>5</sub> averaged 35 % for the 2004 calendar year. Average removal rate of BOD<sub>5</sub> has decreased slightly over the last few years; this is suspected to be due to a greater percentage of soluble BOD<sub>5</sub> that cannot be removed by primary treatment processes. The average removal for TSS for this year was 79 %, about the same reported for the last six years and well above the requirement of 30 %.

Concentrations of other toxic pollutants and pesticides detected in the influent and final effluent were generally lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants (Table 25). Toxic pollutants and pesticides also generally fell within the historical range of values seen in past years; levels of toxic pollutants and pesticides detected in the Anchorage effluent this year and over the previous five years are shown in Table 26. These data indicated some variability over time, but a generally similar pattern overall. Levels were low and often below reporting limits. As in the past, the types and concentrations of measured organic compounds varied between the two sampling periods. This is probably the result of different point sources discharging into the Municipality's wastewater system at various times. Also, in some instances, large differences in pollutant concentrations occurred between the influent and effluent. Inconsistencies can be explained by looking at sampling methodology and plant operation in the case of point-source contaminants. If spikes of contaminants are occurring in the influent, these might be hit or missed during sampling. On the other hand, an effluent sample could contain the contaminant because of mixing in the clarifiers. Differences in concentrations in influent and effluent samples could also be due to lower suspended solids in the effluent samples. This can be seen in Table 11 and Table 12, where greater variability usually occurs in the influent concentrations as compared to the effluent.

Historic discharge monitoring data (1986 - 2004) for other parameters of concern measured in the influent and effluent are presented in Table 28. Most parameters have remained fairly steady over time. Dissolved oxygen levels increased from 1986 with a peak in 1992, then decreased over the last ten years, including 2004. The cause of the changes in DO levels is unknown, however, previous changes in sampling location could account for this. Other constituents of potential concern such as TSS have remained fairly steady in the effluent; influent TSS levels had increased during 1991 due to improved sampling methodology but have remained fairly steady since that time. The BOD<sub>5</sub> effluent average during 2004 (148 mg/L) was lower than that seen during the prior two years. However, BOD<sub>5</sub> levels in both the influent and effluent have shown a slight upward trend as a result of greater industrial contributors over the course of this long-term monitoring program.

**Table 28. Historical Discharge Monitoring Data (1986-Present) for Influent and Effluent Non-Metals.** Values represent a range of minimum (Min) and maximum (Max) results for 1986-1998; the average (Avg), Min, and Max for 1999 (program year running Nov. - Oct.); and Avg, Min, and Max for 2000-2004 (program year running Jan. - Dec.).

Year	Temperature (°C)		pH <sup>a</sup>		TRC (mg/L)		DO (mg/L)		BOD <sub>5</sub> (mg/L)		TSS (mg/L)		Fecal Coliform (FC/100 mL)		Ammonia <sup>b</sup> (mg/L)	
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
1986-1998 Min	9	9	6.4	6.4	NA	0.6	NA	2.1	98	69	117	39	NA	5	NA	NT
1986-1998 Max	17	18	8.0	8.5	NA	1.0	NA	8.6	296	132	307	86	NA	726	NA	NT
1999 Avg	12.6	13.0	NA	NA	NA	0.8	NA	6.0	237	118	241	47	NA	71	NA	NT
1999 Min	10.3	10.5	6.5	6.7	NA	0.7	NA	4.8	203	102	217	41	NA	20	NA	NT
1999 Max	15.6	16.3	7.8	7.9	NA	0.9	NA	6.9	265	128	270	52	NA	201	NA	NT
2000 Avg	12.7	13.1	NA	NA	NA	0.8	NA	5.6	243	135	257	46	NA	83	NA	20.2
2000 Min	10.4	10.8	6.8	6.6	NA	0.7	NA	4.5	209	124	220	39	NA	9	NA	15.0
2000 Max	15.2	15.6	8.2	8.0	NA	0.8	NA	6.4	273	144	295	52	NA	252	NA	24.0
2001 Avg	13.3	13.7	NA	NA	NA	0.8	NA	6.2	243	142	243	46	NA	39	NA	21.0
2001 Min	11.1	11.5	6.9	6.7	NA	0.7	NA	5.2	225	125	223	37	NA	15	NA	13.8
2001 Max	16.0	16.3	7.8	7.6	NA	0.8	NA	6.8	284	156	267	61	NA	119	NA	29.3
2002 Avg	13.1	13.7	NA	NA	NA	0.4	NA	6.7	244	154	241	51	NA	179	NA	20.3
2002 Min	10.4	11.0	6.8	6.5	NA	0.3	NA	6.1	221	132	224	44	NA	32	NA	16.6
2002 Max	15.9	16.4	7.8	7.8	NA	0.5	NA	7.1	268	174	270	57	NA	462	NA	24.0
2003 Avg	13.6	14.0	NA	NA	NA	0.26	NA	4.9	252	161	235	48	NA	210	NA	21.8
2003 Min	11.4	11.2	6.9	6.6	NA	0.07	NA	3.8	228	155	215	44	NA	38	NA	20.3
2003 Max	16.1	17.1	7.8	8.1	NA	0.57	NA	6.3	269	170	252	52	NA	1141	NA	23.5
2004 Avg	12.9	13.6	NA	NA	NA	0.26	NA	3.9	226	148	229	49	NA	325	NA	20.9
2004 Min	10.6	11.2	6.7	6.6	NA	0.1	NA	2.1	205	133	204	45	NA	57	NA	17.2
2004 Max	16.2	17.2	8.0	8.1	NA	0.49	NA	5.2	259	168	280	51	NA	1213	NA	24.2

<sup>a</sup> Values represent yearly pH minimum and maximum

<sup>b</sup> Ammonia testing began September 2000.

NA Not applicable

NT Not tested

The yearly average effluent fecal coliform bacteria concentration reported at 325 MPN/100 mL for 2004 was the highest yearly average seen on the program to date. This is the most likely the result of a program to optimize chlorine usage as described below.

A project to improve the efficiency of the Asplund WPCF effluent disinfection system was implemented during 2001-2002. The existing chlorine injection process was changed by installation of rapid mixing equipment (the "Water Champ", installed in November 2001) to inject chlorine gas directly into the effluent. Oxidation Reduction Potential (ORP) technology using a *Strantrol 890 Controller* was installed in December 2001 to control the chlorine dosage rate by adjusting it in response to both flow and oxidation reduction potential of the wastewater. Prior to this improvement, it was never possible to determine an exact correlation between TRC and coliform kill. Dosage control by the ORP resulted in adequate coliform kills with far lower residuals in 2002, but optimizing the process to minimize chlorine usage, while assuring adequate fecal coliform kill, has been an on-going process. The use of the ORP system has substantially reduced the annual chlorine usage, which decreased from 666,059 pounds in 2001 to 586,224 pounds in 2004. The usage reduction can be attributed to better mixing of the chlorine in the wastewater and more consistent control over the chlorine dosage rate.

The average TRC had dropped from 0.8 mg/L in 2001 to 0.4 mg/L in 2002, and TRC levels fell even lower in 2003 and 2004, with average TRC values of 0.26 mg/L for both of these years. The average fecal coliform monthly average rose from 39 FC MPN/100 mL in 2001 to 179 FC MPN/100 mL in 2002 to 210 FC MPN/100 mL in 2003 and to 325 FC MPN/100 mL in 2004. As noted above, the six exceedances in 2004 of stated permit limits for fecal coliform were attributed to problems with the ORP control, as reported to EPA with the January, March, July, August, and September 2004 DMRs.

***In summary, effluent monitoring indicated that with the exception of fecal coliform, effluent concentrations of toxic pollutants and pesticides, metals and cyanide, and conventional parameters were much lower than their applicable permit limits or their MAECs. For fecal coliform, the monthly geometric mean requirement of not more than 850 FC MPN/100 mL was not met in August 2004, and the criterion of not more than 10 % of the samples exceeding 2600 FC MPN/100 mL was not met during five months of 2004. These elevated fecal coliform levels were attributed to the control of the chlorination dosage system. In addition, all toxic pollutants and pesticides concentrations including metals and cyanide were lower than or within the range of those detected at secondary treatment plants from across the nation.***

### **5.1.2 Sludge Monitoring**

The current permit requires sludge monitoring twice per year, once during the dry conditions in summer and once during wet conditions as part of the toxic pollutant/pretreatment monitoring. There are no Part 503 monitoring requirements included in the reissued permit. Additional sludge monitoring is required because the Part 503 regulations are self-implementing as described in Section 2.1.5. Therefore, monitoring at the Asplund WPCF includes Part 503 monitoring of sludge, which has been included in this report (Table 15). In addition, a separate Part 503 monitoring report for the year 2004 will be submitted to EPA as required by 19 February 2005.

While limits for levels of toxic pollutants and pesticides in sludge are not part of the current permit, comparisons can be made for these data based on other treatment facilities' monitoring

results. Again, data indicate that concentrations of toxic pollutants and pesticides in Anchorage sludge are generally lower than "typical" concentrations seen at other treatment facilities (Table 29). As were the last two years, arsenic concentrations seen in sludge were less than those typically seen, with an average of 3.0 µg/g from the Part 503 monitoring as compared to a typical concentration of 4.6 µg/g. June 2004 and August 2004 sampling values also fell below the typical concentration for arsenic at 3.3 and 2.8 µg/g, respectively. The average mercury concentration in sludge for the 2004 reporting year was 1.32 µg/g, below the typical concentration of 1.49 µg/g. The mercury concentrations seen during the August 2004 toxic pollutant and pesticide sampling slightly exceeded the typical concentration level at 1.57 µg/g, but was still well below the 95<sup>th</sup> percentile "worst case" concentration of 5.84 µg/g. The other Part 503 metals tested (beryllium, cadmium, chromium, lead, and nickel) all fell below typical concentrations.

Other metals included in Table 29 that were monitored but not a requirement of the Part 503 regulations were copper, selenium, and zinc. Copper and zinc concentrations were both below typical concentrations. Selenium values reported for the sludge sample during the June 2004 and August 2004 sampling events were 2.71 and 2.83 µg/g, respectively, as compared to the typical concentration of 1.11 µg/g and a 95<sup>th</sup> percentile concentration of 4.848 µg/g.

Table 30 provides an overview of historical sludge data for total recoverable metals. In general, year 2004 data indicated slightly lowered concentrations of cadmium, chromium, lead and nickel compared to historical data. Values reported in 2004 for mercury and beryllium were generally the same as those reported in the past. Arsenic values appeared to increase slightly compared to historical values, but these values still fell well below the typical and 95<sup>th</sup> percentile concentrations reported for arsenic (Table 29).

## **5.2 WATER QUALITY MONITORING**

### **5.2.1 Plume Dispersion Sampling**

To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, the non-parametric Kruskal-Wallis Test (Zar, 1984) was employed which determined whether significant differences occurred within the sample group. If significant differences were observed, Dunn's test, a test that performs pairwise tests of significance ( $\alpha = 0.05$ ), was employed (Dunn, 1964). The results of these tests for the June survey period as a function of water quality parameters are presented in Table 31. Non-detect values were replaced with the detection limit value for statistical testing.

Data from the receiving water survey showed statistically significant differences between outfall and control stations for dissolved oxygen, salinity, and pH for all depths. Dissolved oxygen was found to have significant differences between the control and each outfall group for the surface depth, and between the control and the nearfield outfall stations at the middle and bottom depths. These differences in dissolved oxygen are the result of the control location having lower DO levels than the outfall locations. Similarly, salinity was found to be significantly different between the control and the nearfield outfall stations for all three depths and between the control and ZID-boundary stations for the middle and bottom depths. This difference was the result of the control stations being slightly more saline; however even though significant differences were found, these differences were very small. In the past the control stations have often been found to be less saline as a result of increased river influence on the north side of Knik Arm. Statistical

**Table 29. Comparison Between Sludge Analysis Results for Anchorage and Typical and Worse Case Concentrations Used by EPA in Developing Median or Mean Environmental Profiles<sup>a</sup>. All concentrations are in µg/g dry weight.**

Pollutant	2004 Anchorage Values			Typical Concentration	95 <sup>th</sup> Percentile "Worse Case"
	June <sup>b</sup>	August <sup>b</sup>	2004 AVG <sup>c</sup>		
Aldrin/Dieldrin	ND(0.500)/ND(0.990)	ND(0.050)/ND(0.100)	---	0.07	0.81
Arsenic	3.3	2.8	3.0	4.6	20.77
Benzene	0.014 J	ND(0.084)	---	0.326	6.58
Benzo(a)anthracene	NT	ND(10.0)	---	0.68	4.8
Benzo(a)pyrene	ND(66.0)	ND(10.0)	---	0.14	1.94
Beryllium	0.18	0.15	0.14	0.313	1.168
Bis(2-ethylhexyl)phthalate	18 J	25	---	94.28	459.25
Cadmium	1.81	3	2	8.15	88.13
Carbon Tetrachloride	ND(0.079)	ND(0.084)	---	0.048	8.006
Chlordane (α,γ)	ND(5.0)	ND(0.500)	---	3.2	12
Chloroform	ND(0.079)	ND(0.084)	---	0.049	1.177
Chromium	16.6	12	16	230.1	1499.7
Copper	253	263	---	409.6	1427
Cyanide	0.17	ND(0.2)	---	476.2	2686.6
DDT/DDE/DDD	ND(0.990)/ND(0.990)/ND(0.990)	ND(0.100)/ND(0.100)/ND(0.100)	---	0.28	0.93
3,3-Dichlorobenzidine	ND(320)	ND(49.0)	---	1.64	2.29
Methylene chloride	ND(0.160)	ND(0.170)	---	1.6	19
Endrin	ND(0.990)	ND(0.100)	---	0.14	0.17
Hexachlorobenzene	ND(66.0)	ND(10.0)	---	0.38	2.18
Hexachlorobutadiene	ND(66.0)	ND(10.0)	---	0.3	8
Lead	28.3	19.8	25.5	248.2	1070.8
gamma-BHC (Lindane)	ND(0.500)	ND(0.050)	---	0.11	0.22
Malathion	ND(0.038)	ND(0.038)	---	0.045	0.63
Mercury	1.12	1.57	1.32	1.49	5.84
Nickel	13.2	15	14	44.7	662.7
PCBs	ND(0.290)	ND(0.098)	---	0.99	2.9
Pentachlorophenol	ND(320)	ND(49.0)	---	0.0865	30.434
Phenanthrene	ND(66.0)	ND(10.0)	---	3.71	20.69
Phenol	ND(66.0)	ND(10.0)	---	4.884	82.06
Selenium	2.71	2.83	---	1.11	4.848
Tetrachloroethene	0.16	0.096	---	0.181	13.707
Trichloroethene	ND(0.079)	ND(0.084)	---	0.46	17.85
2,4,6-Trichlorophenol	ND(66.0)	ND(10.0)	---	2.3	4.6
Vinyl Chloride	ND(0.079)	ND(0.084)	---	0.43	311.942
Zinc	469	492	---	677.6	4580

<sup>a</sup> Source: EPA 1985c. *Summary of Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge: Methods and Results*. Office of Water Regulations and Standards, Appendix F.

<sup>b</sup> Data from NPDES 2004 toxic pollutant and pesticide monitoring

<sup>c</sup> Average from 2004 Part 503 sludge monitoring results

--- Not monitored in-plant for Part 503

J Estimated value

ND ( ) Not detected (detection limit)

NT Not Tested

**Table 30. Historical Discharge Monitoring Data (1986 - Present) for Metals in Sludge.** Concentrations are in mg/kg dry weight. Results for years 1986-1997 represent the range of the results for monthly minimum (Min) and maximum (Max) as available; results for years 1998-1999 represent the average (Avg), Min, and Max values (program years running Nov. – Oct.). Results for 2000 include Avg, Min, or Max of seven monthly values (Jan. - July) and Part 503 monitoring values if available (two or three results in Aug. - Dec. 2000). Results for 2001-2004 represent Part 503 sludge monitoring and toxic pollutant monitoring values.

Year	Arsenic	Beryllium*	Cadmium	Chromium (Total)	Lead	Mercury	Nickel
<b>1986-1997 Min</b>	1.7	<0.02	1.2	3.38	32	<0.1	<8
<b>1986-1997 Max</b>	151	0.22	10.0	48	468	7.3	42
1998 Avg	18.0	0.10	3.0	20	70	1.5	18
1998 Min	3.6	0.07	0.7	5	33	0.7	11
1998 Max	135.8	0.14	5.2	55	294	2.9	26
1999 Avg	9.1	0.11	2.9	21	46	1.9	20
1999 Min	2.2	0.02	1.1	12	32	0.9	10
1999 Max	36.1	0.18	5.2	28	88	4.0	28
2000 Avg	3.6	0.13	2.5	22	37	1.6	21
2000 Min	2.1	0.09	1.8	12	24	0.8	12
2000 Max	4.8	0.19	3.2	49	53	3.2	27
2001 Avg	3.1	0.15	2.6	17	43	1.1	17
2001 Min	2.4	0.12	2.0	12	26	0.5	15
2001 Max	4.0	0.21	3.4	22	91	2.0	19
2002 Avg	2.7	0.13	2.6	20	32	1.2	16
2002 Min	2.1	0.08	2.0	16	22	0.8	10
2002 Max	3.3	0.21	3.6	25	50	3.2	22
2003 Avg	2.2	0.15	1.9	14	29	1.3	20
2003 Min	1.7	0.07	0.7	8	19	0.9	7
2003 Max	2.9	0.23	2.7	19	47	2.1	53
2004 Avg	3.0	0.14	2.0	16	25	1.3	14
2004 Min	2.5	0.11	1.3	11	20	0.7	9
2004 Max	3.8	0.18	3.0	21	30	2.1	17

\* Beryllium testing began in 1993

**Table 31. Significant Station Pairs at the 5 % Significance Level Using the Kruskal-Wallis and Dunn's Tests.**

Parameter	Sample Depth		
	Surface	Middle	Bottom
Temperature*	NS	NS	NS
Salinity*	3,4	2,4 / 3,4	2,4 / 3,4
Dissolved Oxygen*	1,4 / 2,4 / 3,4	3,4	3,4
pH*	1,4 / 2,4 / 3,4	1,4 / 2,4 / 3,4	1,4 / 2,4 / 3,4
Turbidity*	NS	NS	NS
Color Units*	1,4	----	----
Fecal Coliform*	NS	----	----
Total Residual Chlorine*	NS	----	----
Arsenic**	<b>SIG<sup>D</sup>, NS<sup>TR</sup></b>	----	----
Cadmium**	<b>SIG<sup>D</sup>, SIG<sup>TR</sup></b>	----	----
Chromium**	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Copper**	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Mercury**	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Nickel**	<b>SIG<sup>D</sup>, NS<sup>TR</sup></b>	----	----
Lead**	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Silver**	NS <sup>D</sup> , <b>SIG<sup>TR</sup></b>	----	----
Zinc**	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Cyanide**	NS	----	----
Total Suspended Solids**	<b>SIG</b>	----	----
Total Aromatic Hydrocarbons (BETX)**	NS	----	----
Total Aqueous Hydrocarbons (TAqH)**	NS	----	----

\* Statistics performed on Group 1: Within-ZID Stations; Group 2: ZID Boundary Stations; Group 3: Nearfield Stations; and Group 4: Control Stations.

\*\* Statistics performed on stations along outfall Drogue F1 versus the control, Drogue C1.

---- Not Applicable (surface samples only)

NS Not Significant

SIG Significant

<sup>D</sup> Dissolved

<sup>TR</sup> Total Recoverable

analyses also indicated significant differences between the control and all outfall station groupings for pH at all depths as a result of slightly higher pH at the control stations, probably the result of different water masses as seen with the salinity and dissolved oxygen. All pH values fell within the AWQS of 6.5 - 8.5 and values did not vary more than 0.2 pH units, as required by the AWQS. No significant differences were seen for temperature, turbidity, fecal coliform, or TRC. For color, a significant difference was seen between the control and within-ZID stations for the surface, with color ranging from 5 - 15 color units at the control stations versus 15 - 20 at the within ZID stations. Six stations exceeded the AWQS of 15 for color, three within-ZID stations and two ZID-boundary stations had color values of 20, and one nearfield station had a value of 25. High color readings have not been seen in the past, and although the outfall could cause high readings in its immediate vicinity, this would not explain a value of 25 occurring over two kilometers from the discharge. These high values may have been the result of a laboratory analyst reading apparent color with turbidity included rather than true color.

In addition to the standard water quality sampling, concentrations of total aromatic hydrocarbons as BETX and TAqH were measured at the surface at six stations (three at the flood tide control site and three at the flood tide outfall site, along the first drogue track). No statistically significant differences in BTEX or TAqH concentrations were detected between the control and outfall stations. BTEX concentrations above MDLs but not in excess of the State of Alaska water quality standard of 10 µg/L were seen at one control station (C1-1) and at Stations F1-1 and F1-2. Similarly, TAqH concentrations were seen at the same three stations but were significantly less than the AWQS of 15 µg/L. Due to the high number of non-detects for these parameters, the statistical testing was unable to detect differences in BTEX or TAqH concentrations, although a visual inspection of the data indicates that BTEX and TAqH values were elevated at Station F1-1.

Levels of TPAH seen at the outfall stations were generally higher than those seen at the control stations, but all TPAH levels were relatively low.

Total suspended solids, cyanide, and total recoverable and dissolved metals samples collected at the outfall and control sites were also subject to statistical testing. Significant differences were noted in concentrations of TSS, total cadmium and silver, and dissolved arsenic, cadmium, and nickel. Although some of the other total metals concentrations seemed to be slightly higher at the outfall stations versus the control, none of these differences proved to be statistically significant. For total metals, statistical differences were attributed to the much higher TSS concentrations that were apparent at the outfall stations. For dissolved metals, statistically significant differences between control and outfall stations were seen for arsenic, cadmium, and nickel; this was the result of the outfall stations being higher in these parameters. For the outfall stations, concentrations of these metals were highest at Station F1-1 (within ZID). This appeared to be due to influence of the outfall discharge. Concentration of dissolved chromium, copper, lead, mercury, and zinc were also highest at Station F1-1 among the outfall stations, but differences between the outfall and control stations levels were not statistically significant.

A comparison of the water quality data listed in Table 17 with the marine receiving water quality for the State of Alaska (Table 24 and Table 32) indicates that with the exception of six color values and one TRC value, none of the parameters listed in Table 17 exceeded the State's standards. Color exceeded at six of the outfall stations, three were within the ZID, two were on the ZID boundary, and one was at a nearfield station. The highest color value, 25 color units, was seen at a nearfield station and was attributed to the naturally high turbidity in Knik Arm and



**Table 32. State of Alaska Water Quality Standards for Receiving Water.**

Parameter	Most Restrictive Marine Water Quality Standards								
Fecal Coliform	Based on a 5-tube decimal dilution test the fecal coliform median MPN shall not exceed 14 FC/100 mL (harvesting for consumption of raw shellfish); a geometric mean of 20 FC/100 mL (for aquaculture of products not normally cooked and seafood processing); and not more than ten percent (10%) of the samples shall exceed 40 FC/100 mL (aquaculture of products not normally cooked and seafood processing).								
Dissolved Oxygen	Dissolved oxygen concentrations in estuaries and tidal tributaries shall not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.								
pH	pH shall not be less than 6.5 or greater than 8.5, and shall not vary more than 0.2 pH unit from natural condition.								
Turbidity	Turbidity may not exceed the natural condition.								
Temperature	Temperature shall not cause the weekly average temperature to increase more than 1°C. The maximum rate of change shall not exceed 0.5°C per hour. Normal daily temperature cycles shall not be altered in amplitude or frequency.								
Salinity	Maximum allowable variation above natural salinity: <table> <tr> <th>Natural Salinity (‰)</th><th>Man-induced Salinity (‰)</th></tr> <tr> <td>0 to 3.5</td><td>1</td></tr> <tr> <td>3.5 to 13.5</td><td>2</td></tr> <tr> <td>13.5 to 35.0</td><td>4</td></tr> </table>	Natural Salinity (‰)	Man-induced Salinity (‰)	0 to 3.5	1	3.5 to 13.5	2	13.5 to 35.0	4
Natural Salinity (‰)	Man-induced Salinity (‰)								
0 to 3.5	1								
3.5 to 13.5	2								
13.5 to 35.0	4								
Sediment	No measurable increase in concentrations above natural conditions.								
Color	Color shall not exceed 15 color units.								
Petroleum Hydrocarbons, Oils and Grease	Total aqueous hydrocarbons (TAQH) in the water column shall not exceed 15 µg/L. Total aromatic hydrocarbons (TAH) in the water column shall not exceed 10 µg/L. Shall not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils.								
Total Residual Chlorine	Concentrations shall not exceed 2.0 µg/L for salmonid fish or 10.0 µg/L for other organisms.								
Toxic and Other Deleterious Substances	See Table 24.								

not a result of the effluent discharge. As noted in Section 3.2.1, all of the TRC concentrations were below the PQL of 0.005 mg/L, except for one station which was located at the ZID boundary (E2-2). It should be noted that the method detection limit achievable for TRC analysis (0.005 mg/L) is higher than the State-specified limit of 0.002 mg/L (for salmonid fish). As previously noted, although the amperometric method that was used is the preferred method due to fewer interferences, all TRC methods are subject to positive interferences in estuarine or marine waters. In past years, some of the highest TRC levels were seen at the control stations.

The State's receiving water quality standard for the "growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers" is 15 µg/L for TAqH and 10 µg/L for total aromatic hydrocarbons. As seen in Table 19, these standards were not exceeded during the receiving water sampling. For two control stations (C1-2 and C1-3) and the one outfall station (F1-3), BETX was not detected, with method detection limits well below the state standards. In addition, for "contact recreation", the AWQS for hydrocarbons is as follows: "Shall not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils." No film, sheen, or discoloration was observed during the receiving water sampling program in 2004.

All the dissolved metals tested in receiving water (Table 18) as part of this program met the AWQS except copper at Station F1-1 which is within the ZID as shown in Table 24. This included arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. Testing of antimony, beryllium, selenium, and thallium in receiving water is not required by the permit and was not performed this year. Previous years of monitoring showed exceedances of water quality criteria for total recoverable metals that were due to the specified test methods in conjunction with high amounts of suspended particulates in Cook Inlet. Since the adoption of the more-appropriate SSWQC for dissolved metals in May 1999, the receiving waters of Cook Inlet near the Asplund WPCF discharge have been in compliance with the AWQS.

All cyanide samples collected during the receiving water sampling were below the detection limit of 1 µg/L as compared to the State-specified criteria of 1 µg/L for marine aquatic life. The cyanide concentration in the effluent was reported at 1.4 µg/L for the sample, well below the MAEC of 181 µg/L.

***In summation, statistical analyses of the 2004 receiving water quality data indicated that water quality outside the ZID was not degraded with respect to control stations for most parameters. Differences that were noted in some parameters such as dissolved oxygen, salinity, and pH were unlikely to be influenced by the Asplund WPCF outfall. With the exception of dissolved copper which exceeded the AWQS at the within-ZID station (F1-1), color which exceeded at six stations due to possible outfall affects for the within-ZID stations and high turbidity at ZID boundary and nearfield stations, and TRC which exceeded at one ZID-boundary station (E2-2), all AWQS were met for the Asplund WPCF receiving water quality program. Although some parameters such as hydrocarbons and some metals were clearly elevated at the within-ZID station (F1-1), other than copper, no values exceeded AWQS. No statistically significant differences were seen for BETX or TAqH hydrocarbon concentrations between the outfall and control locations. Statistically significant increases in dissolved arsenic, cadmium, and nickel were seen between control and outfall stations; however, all concentrations were well below the AWQS. Statistically significant increases in total recoverable cadmium and silver were not attributed to the outfall but were more likely attributable to natural variation in TSS concentrations in Knik Arm.***

### 5.2.2 Fecal Coliform Bacteria

The ADEC has indicated that one of their primary concerns is bacterial contamination of the shoreline by the Asplund discharge, indicated by fecal coliform bacteria concentrations. Because the Knik Arm's water uses have not been classified, regulations provide that the most restrictive standard must apply. State marine water quality standards for contact recreation require that the geometric mean fecal coliform concentration taken within a 30-day period not exceed 100 FC MPN/100 mL and that not more than one sample, or more than 10 % of the samples if there are more than 10, exceed 200 FC MPN/100 mL. Criteria for secondary recreation and for industrial water supply require that the mean fecal coliform concentration not exceed 200 FC MPN/100 mL and that not more than 10 % of the samples exceed 400 FC MPN/100 mL. State marine water quality criteria for the harvesting for consumption of raw mollusks and other raw aquatic life require that, based on a 5-tube decimal dilution test, the median shall not exceed 14 FC MPN/100 mL, and that not more than 10 % of the samples shall exceed 43 FC MPN/100 mL. For seafood processing water supply for products not normally cooked, criteria are that the geometric mean may not exceed 20 FC MPN/100 mL, and not more than 10 % of the samples shall exceed 40 FC MPN/100 mL. For seafood processing water supply for products normally cooked, criteria are that the geometric mean may not exceed 200 FC MPN/100 mL, and not more than 10 % of the samples shall exceed 400 FC MPN/100 mL. For aquaculture water supply, criteria are that the geometric mean may not exceed 20 FC MPN/100 mL and not more than 10 % of the samples may exceed 40 FC MPN/100 mL.

Since the harvesting of shellfish and other raw aquatic life is not performed in these waters, and there is no aquaculture or seafood processing, it seems that the criteria for secondary recreation is most applicable; however, these criteria are not the most restrictive. Therefore, the most restrictive criteria used were that the median shall not exceed 14 FC MPN/100 mL (consumption of raw shellfish and other aquatic life), the geometric mean shall not exceed 20 FC MPN/100 mL (seafood processing and aquaculture for raw consumption), and not more than 10 % shall exceed 40 FC MPN/100 mL (seafood processing and aquaculture for raw consumption; Table 32).

Statistical tests indicated that fecal coliform concentrations were not-significantly different between the within-ZID, ZID boundary, and the nearfield outfall station groups as compared to the control stations (refer to Table 31). Fecal coliform concentrations values ranged from <2 to 17 FC MPN/100 mL at the outfall stations (including the ZID stations) compared to range of <2 to 4 FC MPN/100 mL at the control stations. The median at the control stations was <2 FC MPN/100 mL. The median at the outfall stations outside the ZID for both ebb and flood tides was also <2 FC MPN/100 mL, well within the 14 FC MPN/100 mL criterion. The control site had a geometric mean of 2.1 FC MPN/100 mL, while that at the outfall stations outside the ZID was 2.0 FC MPN/100 mL, both well below the criterion of 20 FC MPN/100 mL. No measurements (0 %) at the outfall stations outside the ZID exceeded 40 FC MPN/100 mL, compared to the criteria of not more than 10 % of the measurements may exceed 40 FC MPN/100 mL. While the highest fecal coliform concentration (17 FC MPN/100 mL) was seen at the within-ZID Station F1-1, the next highest value (4 FC MPN/100 mL) was seen at the control site.

Low fecal coliform bacterial concentrations were seen in all three creeks sampled. The two replicate fecal coliform concentrations measured in Fish Creek were <2 and 2 FC MPN/100 mL.

Replicate concentrations measured in Ship Creek were 2 and 2 FC MPN/100 mL, while those at Chester Creek were 2 and <2 FC MPN/100 mL.

The range of fecal coliform concentrations for all intertidal samples collected during 2004 was quite low at <2 to 7 FC MPN/100 mL, with a median of 2 FC MPN/100 mL and a geometric mean of 2.5 FC MPN/100 mL. These values met the most restrictive water quality criterion of a median of 14 FC MPN/100 mL and a geometric mean of 20 FC MPN/100 mL. The highest coliform concentrations were seen at Stations IT-2, 1200 m east of the outfall; IT-3, 750 m east of the outfall; IT-6, 750 m southwest of the outfall, and IT-C, the control site near Point MacKenzie. Due to the varied distribution of these values, it is not clear that they are an outfall related impact. The criterion of not more than 10 % of the samples exceeding 40 FC 100/mL was met, as none of the intertidal measurements exceeded this value. As in the past, some of the slightly elevated fecal concentrations seen intertidally may be the result of heavy waterfowl use of the area. Fecal coliform concentrations in the effluent samples collected in conjunction with the receiving water, intertidal sampling, and stream sampling were reported at 2 and <2 FC MPN/100 mL for the two replicates.

*In summary, fecal coliform concentrations in 2004 were found be very low in both the receiving water and intertidal areas and no statistically significant differences were seen between station groupings for the ZID, ZID-boundary, or nearfield stations as compared to the control location. Area creeks were also found to be low in fecal coliform concentrations in 2004. Fecal coliform samples collected at the outfall stations outside the ZID during the receiving water sampling program met all AWQS criteria. All fecal coliform samples collected from intertidal areas also met all water quality criteria.*

### 5.3 BIOACCUMULATION MONITORING

The bioaccumulation program was to include sampling of the yellow-green algae *Vaucheria* spp. from two intertidal locations. However, due to insufficient algae growth during both the summers of 2003 and 2004, the planned algal bioaccumulation program could not be performed. This algae is normally associated with brackish water and often is present near high tide level near river mouths or in areas of seepage and runoff of freshwater (Kozloff, 1993). Since the summers of 2003 and 2004 were relatively dry with low runoff, it is speculated that the Upper Cook Inlet in the vicinity of Anchorage was higher in salinity than normal which inhibited the normal growth of this algae. The mud-flats near the outfall were observed throughout the summer, and the extensive mats of *Vaucheria* spp. that normally grow each summer were never present during 2003 or 2004. In consultation with AWWU and discussions with EPA, it was decided to propose a bioaccumulation program based on the collection of Pacific cod (*Gadus macrocephalus*) from the shallow subtidal/intertidal area at the two locations in order to fulfill permit objectives. A proposed study plan was prepared and submitted to EPA in September 2004. EPA approved the proposed study, and the study was conducted in October 2004.

Most metal concentrations in the Pacific cod tissue samples were low and/or below detection limits. Arsenic, copper, and zinc were detected in all replicate samples collected from both the outfall and control locations. Mercury and selenium were also detected in some of the replicates from each location. To test the hypothesis that the bioaccumulation of metals in fish near the outfall was not significantly different from the control, the non-parametric Kruskal-Wallis Test (Zar, 1984) was employed which determined whether significant differences ( $\alpha = 0.05$ ) occurred between the two sample groups. Non-detect values were replaced with the detection

limit value for statistical testing. Concentrations of these five metals were found to be very similar between the two sites, and no statistically significant differences were found. Concentrations of antimony, beryllium, cadmium, chromium, cyanide, lead, nickel, silver, and thallium were below the laboratory detection limits for all samples.

Organic analyses of the tissue samples included PCBs, semi-volatile organics and PAHs, and pesticides. No PCBs were seen in any samples. Detectable concentrations of three semi-volatile analytes were seen in the bioaccumulation samples. These concentrations were at or below the MRL and qualified for matrix interference problems. A total of 14 different pesticides were seen in the tissue analyses, with most estimated values that were below the ultra-low level detection limits utilized for the program. Concentrations were similar between the outfall and control locations, and no evidence was found that would indicate that the Point Woronzof discharge was the source of these pesticides.

*In summary, intertidal bioaccumulation analyses performed this year on Pacific cod indicated that outfall and control sites were similar in terms of chemical concentrations. Most toxic pollutants and pesticides were found to be at or below the trace-level detection limits that were utilized on the program. Concentrations of metals and organic pollutants that were reported were very low, and no statistically significant differences were seen between the outfall and control locations. There was no evidence of impacts that could be attributed to the Asplund WPCF outfall.*



## 6.0 CONCLUSIONS

The following conclusions were based on results from this year of monitoring as compared to the current NPDES permit:

- The influent, effluent, and sludge monitoring has shown that, with the exception of only fecal coliform, the Asplund WPCF met the NPDES permit requirements and complied with State of Alaska water quality standards. MOA's self-monitoring of TRC, pH, BOD<sub>5</sub>, and TSS showed compliance with all 2004 permit effluent limitations.
- The maximum geometric mean of 850 FC MPN/100 mL was exceeded in August 2004 for fecal coliform, when a mean of 1,213 FC MPN/100 mL was reported. Fecal coliform exceeded the monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" in January, March, July, August, and September 2004. Exceedances resulted from the continuing adjustment of the ORP chlorine feed control system in an effort to optimize chlorine use.
- Yearly average percent removals for BOD<sub>5</sub> (35 %) and TSS (79 %) were considerably better than the 30 % required by the amendment to the Clean Water Act (40 CFR Part 125; Final Rule, 8/9/94). Although not a permit requirement, BOD<sub>5</sub> (29 %) in January was less than the 30 % removal guideline.
- Total aqueous hydrocarbon and total aromatic hydrocarbon concentrations in the effluent were below their respective MAECs, as was total ammonia.
- Cyanide and metals concentrations in the effluent never exceeded their MAECs during any of the sampling events.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were generally within the established range or lower than values from a national study of secondary treatment plants. Most toxic pollutant sludge concentrations were within the established range or lower than values from a national study of secondary treatment plants, with some metals falling outside typical concentrations but well below 95<sup>th</sup> percentile worst case values.
- Whole effluent toxicity testing conducted quarterly during 2004 met the permit limitations for chronic toxicity.
- To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, statistical comparisons were employed. Conventional parameters such as dissolved oxygen, salinity, and pH did show statistically significant differences between stations, but these were not ascribed to the outfall. Rather, these have historically been seen when comparing the Point Woronzof region to the slightly different water mass properties across Knik Arm at the control site. No significant differences were seen for temperature or turbidity.
- Fecal coliform concentrations in offshore receiving water samples were found to be very low everywhere. State-specified criteria of a median of 14 FC MPN/100 mL, a geometric mean of 20 FC MPN/100 mL, and of not more than 10 % of the samples exceeding 40

FC MPN/100 mL were met at all receiving water locations. All fecal coliform samples collected from intertidal areas also met water quality criteria.

- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that background levels of dissolved metals were all below the State site-specific water quality standards. Dissolved copper exceeded the site-specific standard at the diffuser, but since this was a within-ZID location is not considered a violation in Alaska Water Quality Standards. Significant differences between the outfall and control stations were seen for dissolved arsenic, cadmium, and nickel, which were elevated at the outfall. These increased concentrations as compared to controls may be attributed to the outfall, but these dissolved metals still met water quality standards. Total recoverable metals were elevated compared to the dissolved, as expected, and this was attributed to high suspended sediment loads. Only total recoverable cadmium and silver were significantly elevated at the outfall stations as compared to the control, also possibly due to increased suspended sediment levels.
- All cyanide concentrations in receiving waters were below detection limits of 1.0 µg/L compared to the receiving water quality limit of 1.0 µg/L.
- Supplemental receiving water samples also demonstrated that total aromatic hydrocarbons and total aqueous hydrocarbons met the State's water quality standard at all locations. While no statistically significant differences were detected between concentrations at the control and outfall stations for either total aromatic hydrocarbons or total aqueous hydrocarbons, slightly elevated levels were seen at the within-ZID boundary station that were attributed to the effluent discharge.
- Turbidity met the State water quality criteria at all stations. TRC exceeded the most restrictive AWQS of 2.0 µg/L at one station on the ZID boundary. Color was found to exceed State water quality criteria for six samples, five of which were within or on the ZID boundary and not considered a violation of AWQS. These exceedances however, could not be completely attributed to the outfall as the highest value was at a far removed location and may have been due to the naturally high suspended sediment in Knik Arm.
- Shallow subtidal/intertidal bioaccumulation analyses of Pacific cod showed no evidence of outfall impacts. Data from outfall and control sites were similar in terms of chemical concentrations, with most semi-volatile compounds and pesticides, found to be at or below detection limits. Arsenic, copper, mercury, selenium, and zinc were detected in the tissues at low concentrations, but no statistically significant differences were seen between the outfall and control locations. There was no evidence that pollutants attributable to the outfall are bioaccumulating in the resident biota in Knik Arm.

## CONCLUSIONS

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements with few exceptions and is showing no significant impacts to the marine environment.



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